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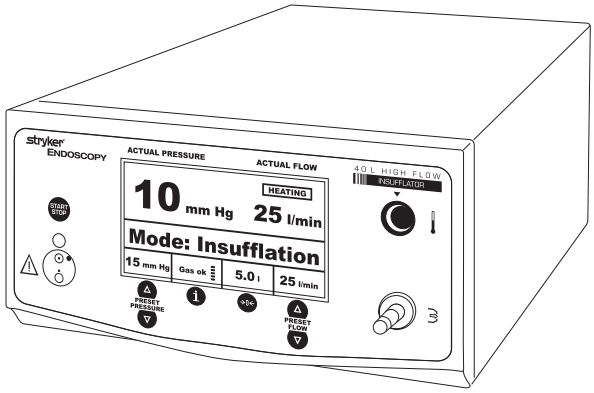
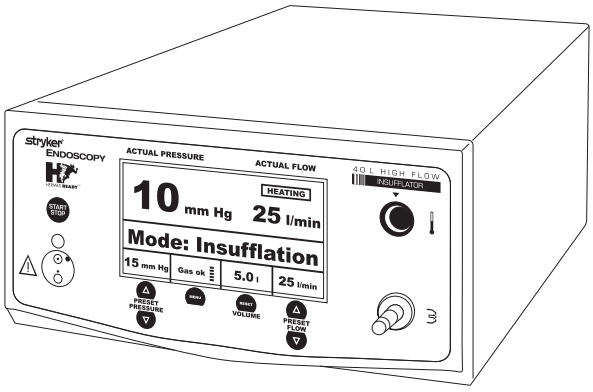
# 40L HIGH FLOW INSUFFLATOR




**Standard Model**




**Hermes Ready Model**

SERVICE MANUAL

F105/200-6031-0/0702/AMA

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## Safety Instructions

### Liability

Device and additional equipment have been carefully and thoroughly tested at the factory before shipping. The manufacturer is only responsible for the safety and reliability as well as performance of the product if all tests and repairs are carried out by qualified and authorized personnel and the device and all additional equipment is employed according to its proper and intended use.

**WARNING**

**Maintenance, repair, or modifications may be carried out only by personnel authorized by the manufacturer. The electrical installation of the power supply has to comply with DIN/IEC rules and regulations.**

An authorized service technician has to inspect and service the device every two years to ensure the safety and functionality of the unit. If the service interval is not adhered to, the manufacturer does not assume any liability for the functional safety of the device.

Service technicians are to be trained and certified only by the manufacturer.

The manufacturer is not liable for direct or consequential damages; the warranty is null and void if

- the device or any additional equipment is used improperly..
- instructions and rules of the manual are not observed.
- the device or any additional equipment is used, prepared, or maintained/repaired improperly.
- non-authorized personnel carries out repairs, adjustments, or modifications on the device or any additional equipment.
- the prescribed inspection and maintenance intervals are exceeded.

Receiving technical documents does not constitute authorization to repair, adjust, or modify the device or any additional equipment.

Proper care and maintenance of the device and any additional equipment is required to ensure safe operation. Function and operational of the device and additional equipment thus have to be checked after each maintenance session to protect patient and operator. New factory supplied and repaired products have to be prepared before first use (see manual).

### Protection from Germs

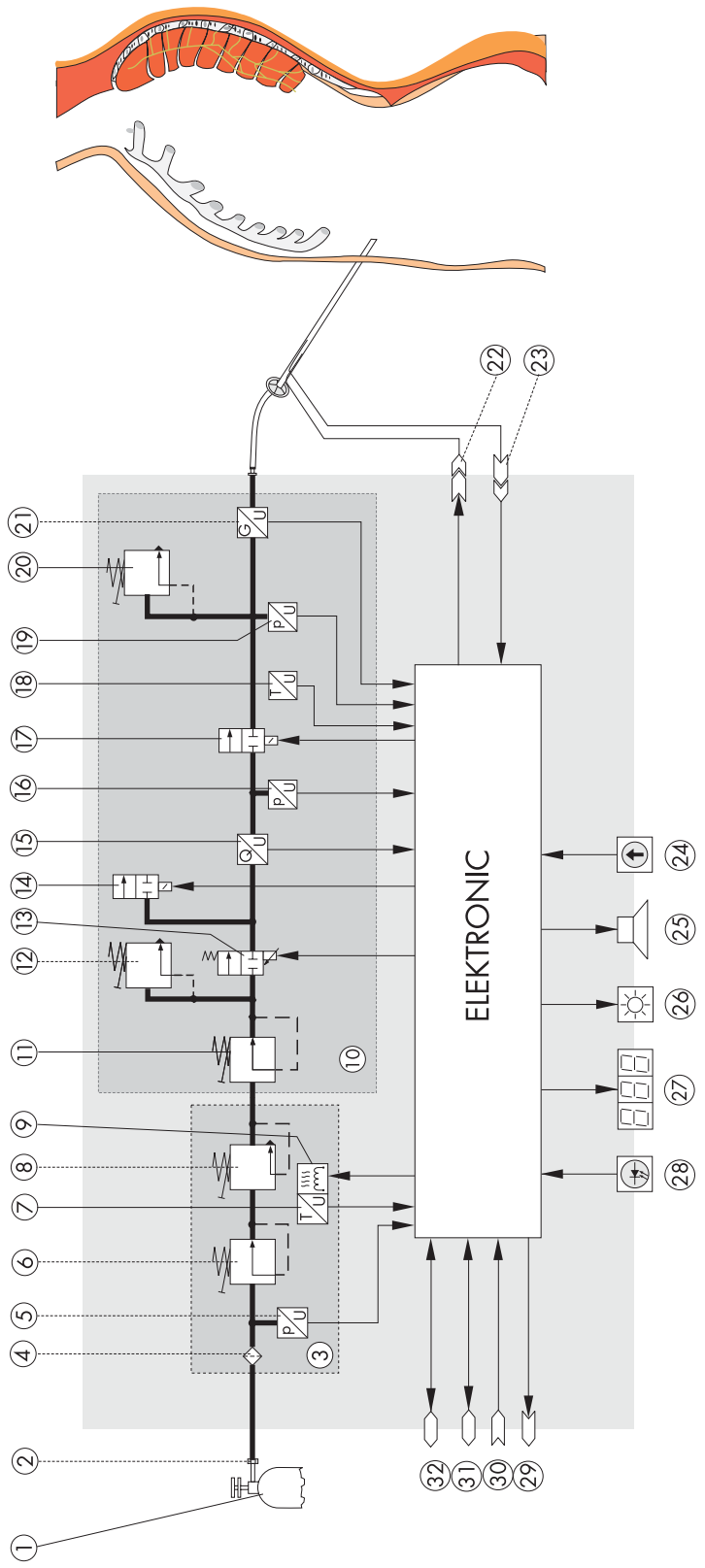
Devices, instruments, and any additional equipment returned for repairs have to be prepared before shipping according to the manual to protect the service personnel and ensure safety during transport. If this is not possible,

- the contaminated product has to be clearly marked referencing the type of contamination and
- has to be shrink-wrapped in two layers of safety foil.

### Certificate

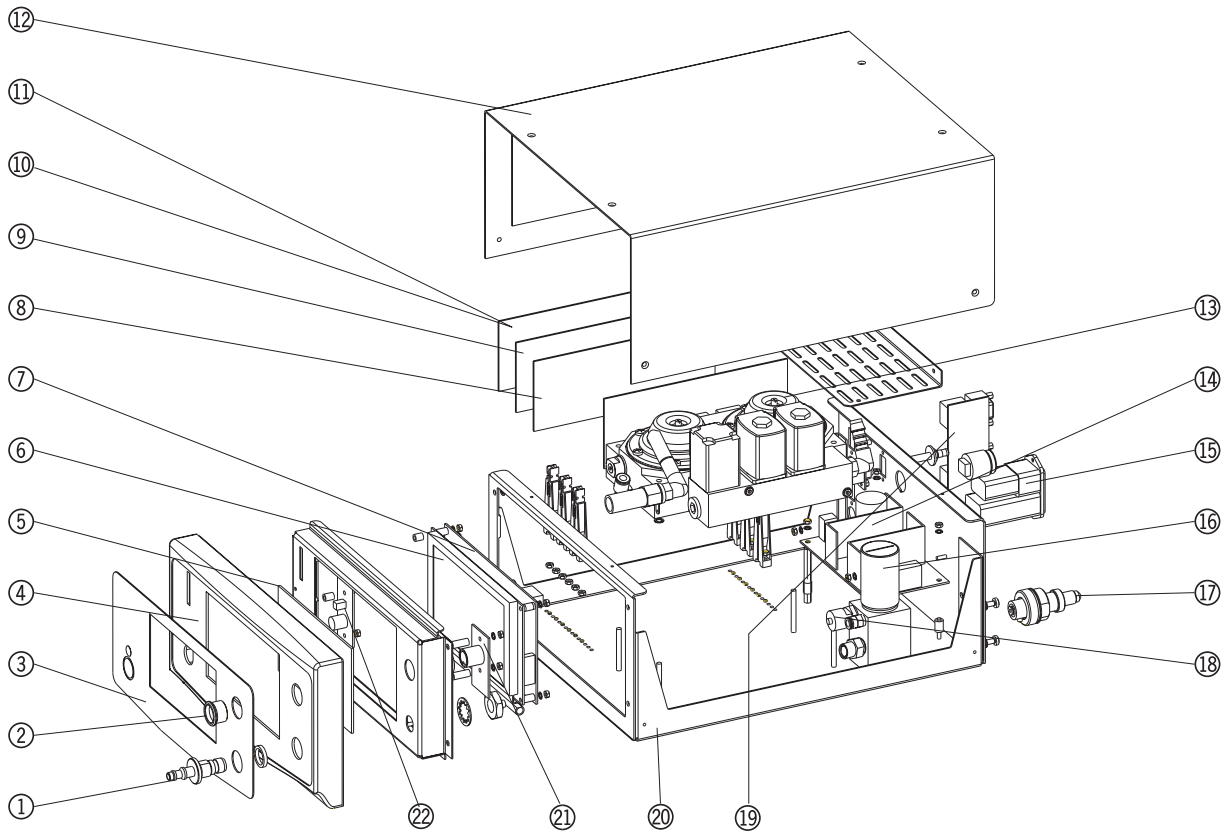
The device or instrument operator has to be provided with a certificate about the scope and extent of the performed services/repairs. This certificate has to list the date of the service as well as the company together with a signature. Please use the maintenance and checklist included in the back of the service manual.

## 1-1 Functional Diagram F105



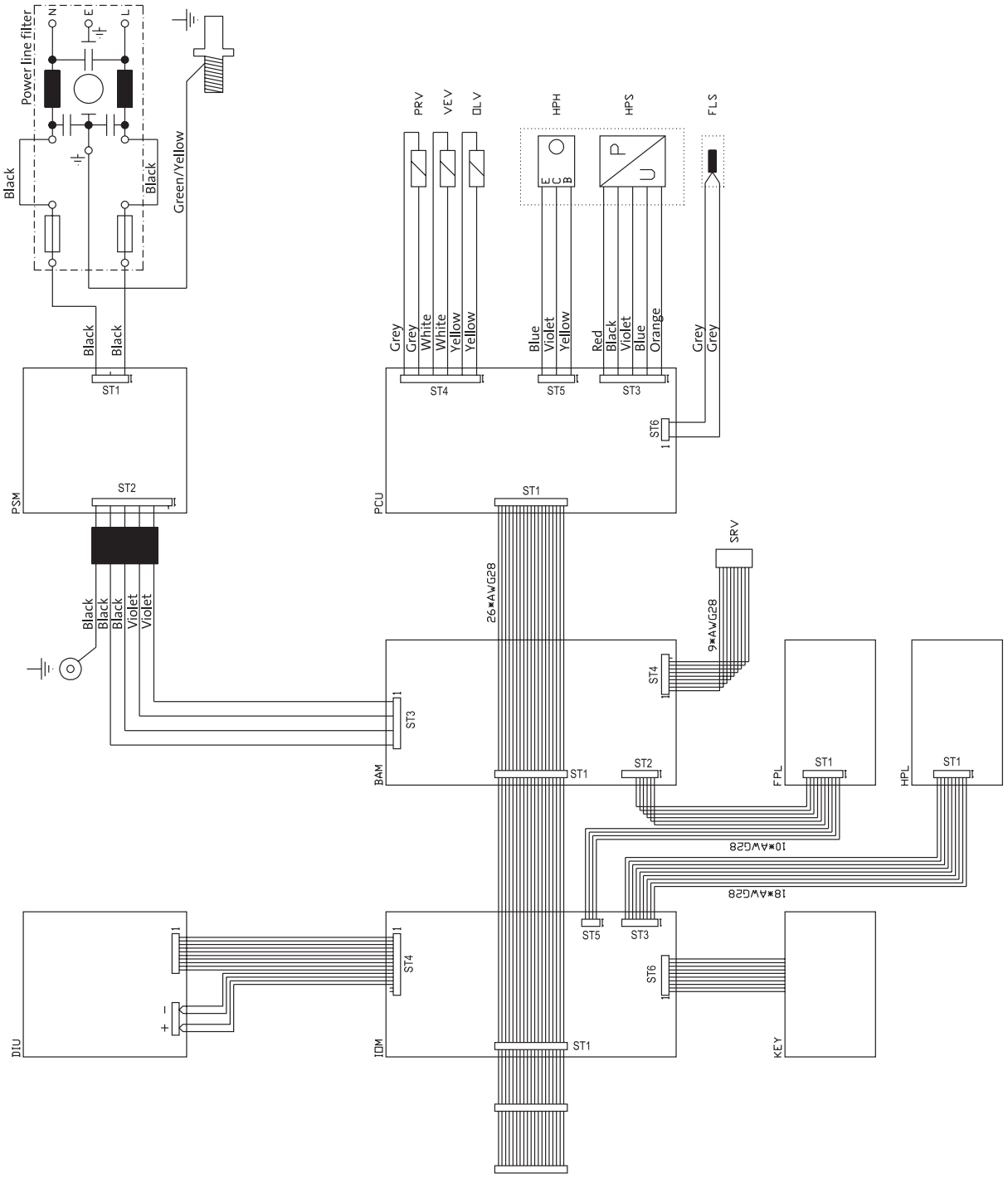

1. Gas bottle
2. Gas bottle connection
3. High pressure unit (HPU)
4. Filter
5. High pressure sensor 60 bar
6. High pressure regulating valve 3 bar
7. Temperature sensor - 40 to + 70 °C
8. High pressure safety valve 3.5 bar
9. Heater for high pressure unit
10. Low pressure unit
11. Low pressure regulating valve 120 mmHg
12. Medium pressure safety valve 500 mmHg
13. Controllable pressure reducer
14. Solenoid valve
15. Flow sensor
16. Pressure sensor I
17. 2/2 way valve, normal closed
18. Temperature sensor
19. Pressurse sensor II
20. Low pressure safety valve 55 mmHg
21. Fluid sensor
22. Heating wire for gas heating
23. Temperature sensor for gas heating
24. Foil keyboard
25. Speaker
26. Warning displays
27. LCD display
28. Remote control receiver
29. Video OUT
30. Video IN
31. Serial interface
32. Service interface

## 1-2 Explosion Diagram




1. Insufflation tube connection
2. Gas heater connection
3. Front plate / Design foil
4. Front plate
5. Cloth sealing strip
6. LCD display
7. Graphic board
8. Basic module BAM 01
9. I/O module IOM 01
10. Video module VIM 01 (alternate option)
11. Interface-Modul IFM 01(alternate option)
12. Upper section of case
13. Low pressure unit LPU 01
14. Power plug
15. Non-heating plug with safety catch
16. High pressure unit HPU 01
17. Gas connection Co2
18. High pressure safety valve
19. Video In/Out board
20. Bottom of case
21. Heater board HPL
22. Front board FPL

## 1-3 Cable Layout Plan



1 Introduction/Basics

This device has to be serviced every two years. The chapter **Function Test** describes this routine inspection.

Please use the maintenance and checklist included in the back of the service manual to document the bi-annual inspection.

## 1-4 Testing Tools and Resources

The following tools and resources are required to perform the maintenance and service tasks described in this manual. Please make sure that all tools and resources are calibrated and in perfect working order before commencing any service or maintenance tasks.

- Manometer Range 0-70 mm Hg, Test Class 1.0
- Manometer Range 0-7 bar, Test Class 1.6
- Manometer Range 0-100 bar, Test Class 1.6
- Silicone Tube 8x2 mm
- PVC Tube 6x4 mm, 1 m
- T Connector 8-8-8 mm
- Flow Column Range 0-20 l/min CO2 Max. Pressure Drop at 9 l/min < 10 mbar
- Flow Column Range 0-40 l/min CO2 Max. Pressure Drop at 9 l/min < 10 mbar
- Veress Hollow Needle Length 100 mm, Opening Diameter 1.4 mm, Inner Diameter 1.6 mm
- Heater Calibration Box T100/T101

- Universal Multimeter

## 1-5 Front of the Device

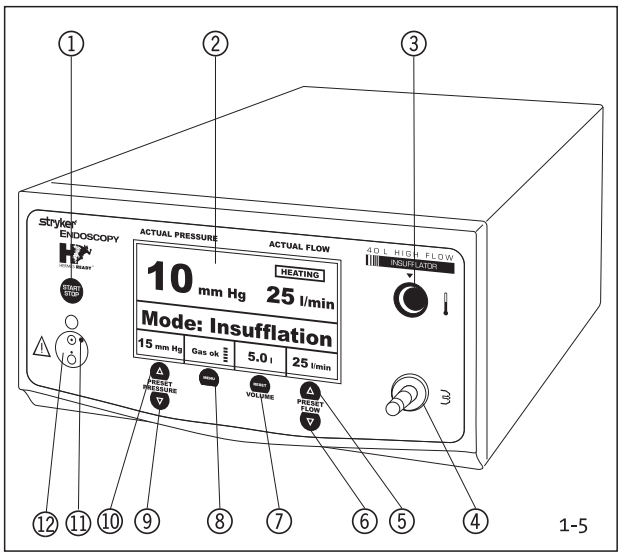



**Fig. 1-5: : F105 Front Control and Display Elements**

① Start/Stop Key
② Display
③ Gas Heater Connection
④ Insufflation Tube Connection
⑤ Nominal Gas Flow +
⑥ Nominal Gas Flow -
⑦ Gas Consumption Reset Key
⑧ Menu Key
⑨ Nominal Pressure -
⑩ Nominal Pressure +
⑪ Line Voltage LED
⑫ ON/OFF Key

1 Introduction/Basics

## 1-6 Rear of the Device

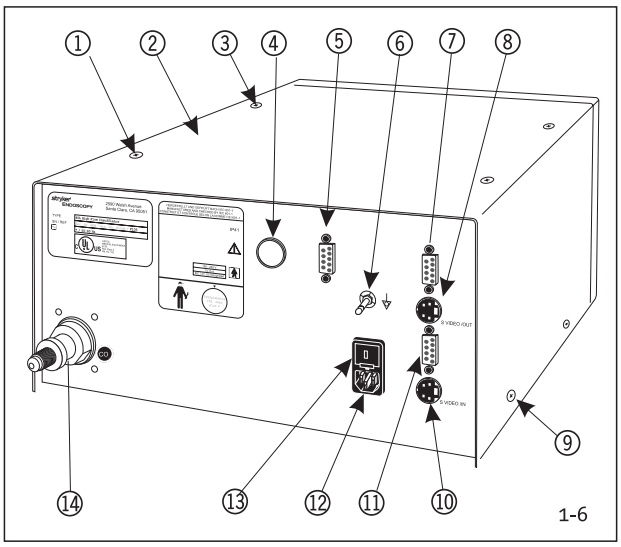



**Fig. 1-6: Connection Elements, Rear of the Device**

① Recessed Head Screw to Fasten Case
② Case Cover
③ Recessed Head Screw to Fasten Case
④ Blank Cover HERMES (Optional)
⑤ Service Interface
⑥ Potential Equalization Plug
⑦ Video Output RGB/FBAS
⑧ Video Output SVHS
⑨ Recessed Head Screw to Fasten Case
⑩ Video Input SVHS
⑪ Video Input RGB/FBAS
⑫ Power Pack Plug
⑬ Fuse Holder
⑭ Gas Connection

## 1-7 Opening the Device

1. You will need a recessed head screwdriver (Phillips) size 2 to open the device.
2. (See Fig. 1-6)
   Remove four screws from top ① and two screws from each side ⑨.
3. Lift the case cover panel ② towards the top and remove.

2 Function Test

## 2-1 Safety Test

Trained personnel has to perform a safety test as part of the annual system inspection.

1. Perform a visual inspection. Make sure that
- the fuse corresponds with the specifications indicated by the manufacturer
- labels and stickers on device are legible
- the mechanical condition of the unit allows for safe operation
- the device is clean
2. Measure leakage currents according to DIN EN 60601-1/ IEC 601-1.
3. Measure protective conductor resistance according to DIN EN 60601-1/IEC 601-1. The protective conductor resistance is measured while device is connected to the power supply. The maximum value is 0.2 Ω.
4. Measure the insulation resistance with 500-700 V DC. The min. value is 50 MΩ. The electric strength with high voltage cannot be measured.

As an alternative, perform safety test according to DIN VDE 0751 Section 1.

## 2-2 Damages Caused by Disinfectants, UV Rays, etc.

The surfaces of the device components can be changed and/or damaged by disinfectants used in the operating room or the ozone released during the use of UV emitters. This requires the following inspections:

**Cabling**
The cables are to be checked for proper fit and condition. Any cables suspected of being damaged or flawed in any way (e.g., insufficient insulation, breaks, malfunctioning contacts, etc.) are to be replaced.

**Electronic Boards**
If the boards show signs of corrosion or other damage to the contacts or soldering joints, they are to be replaced to ensure the safety of the device/system.

**Front Panel and Case**
Front panel and case are to be checked for damage. Check for safety-and function-relevant damages. The proper function of the control panel and displays is to be checked.

**Tubing**
Fluid can enter the device via the insufflation tube connection. This is detectable through the residue visible in the transparent tube in the area of the tube nozzle. If this is the case, please replace the entire pneumatics block.

## 2-3 Testing the High Pressure Unit (HPU)

The high-pressure unit consists of the following:

- Gas Intake Filter GIF
- High Pressure Sensor HPS
- High Pressure Controller HPC
- High Pressure Heater HPH
- High Pressure Valve HPV

**Testing High Pressure Unit for Leaks**

1. Connect manometer (0-70 bar) to gas bottle connection.
2. Remove tube (press plastic ring and pull out tube) from HPU ② output and connect a 0-7 bar manometer.
3. Connect gas supply.
4. Briefly open and then reclose the gas supply.
5. Wait 10 min. Pressure at 70-bar manometer may not have dropped more than 5 bar.

**Adjustment**
- Check gas connection
- Replace high-pressure unit HPU

**High Pressure Valve HPV**

1. Open the gas supply line.
2. Use a felt marker to mark the position of the adjustment screw ① of the high-pressure controller (Fig. 2-3-1).

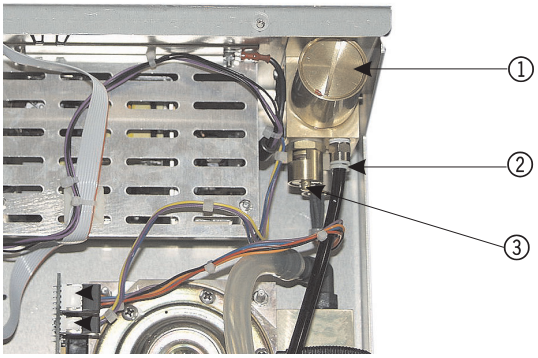



**Fig. 2-3-1: Position of High Pressure Unit HPU**

3. Turn adjustment screw ① at high-pressure controller to increase pressure until triggering of the high-pressure valve ③ can be clearly heard (hissing sound).
4. Reverse screw ① until you can no longer hear any hissing sound. The then reached pressure has to be above 4 bar.
5. Reset the adjustment screw to the marked position.

**Adjustment**
- Use the adjustment screw ③ of the high-pressure valve for any adjustments.

**High Pressure Regulator HPR**

**NOTE**

**The output value drops with rising temperature (e.g., long operating hours).**

1. Relieve pressure of tube at magnetic valve (briefly remove and reconnect tube) until a stable final value of 3.2 bar is reached (±0.6).
2. Remove manometer and reconnect tube.

2 Function Test

**Adjustment**

- Use the adjustment screw ① of the high-pressure controller for any adjustments.

## 2-4 Testing the Low Pressure Regulator LPR

1. Open the gas supply line.
2. In the service menu, open the "LPR Adjust" menu option and check the settings. (Adjust with adjustment screw, Fig. 2-4-1)

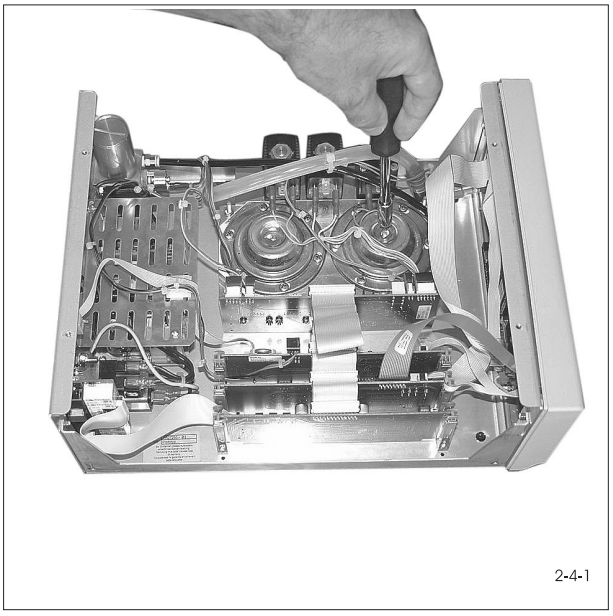



**Fig. 2-4-1: F105 Low Pressure Controller Settings**

## 2-5 Low Pressure Safety Valve LSV

Close device exit using a tube clamp (Fig. 2-6-1 , ④ ).

In the service menu, open the "LSV Adjust" menu option and check the settings.

**Adjustment**

Use the adjustment screw of the low-pressure safety valve for a slight adjustments.

## 2-6 Testing Low Pressure Unit for Leaks

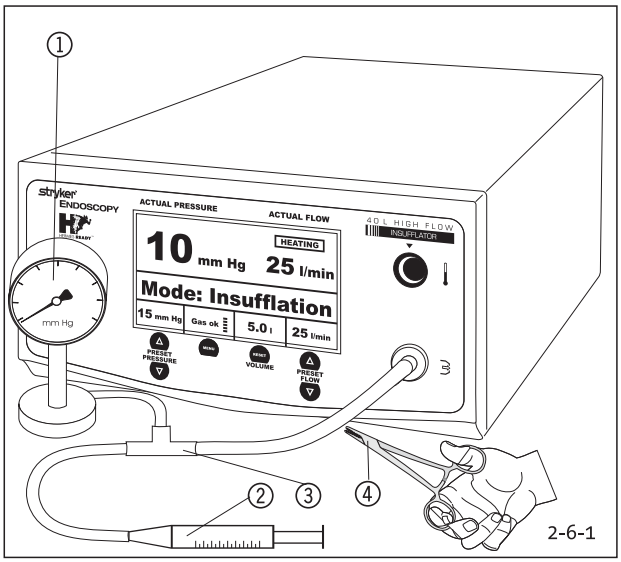



**Fig. 2-6-1: Test Layout: Low Pressure Unit Leakage Test**

① Manometer (0-70 mm Hg)
② Syringe
③ T-Connector

1. Attach manometer ① , air-filled syringe ② , tube, and T-connector ③ to the insufflation tube connection.
2. Use the syringe to generate a pressure of at least 50 mm Hg. Clamp tube at 50 mm Hg.
3. Wait 30 seconds. Pressure at manometer may not have dropped more than max. 2 mm Hg.

**Adjustment**

- Check fluid sensor and low-pressure unit tube(and replace if necessary).

## 2-7 Testing Flow Volume

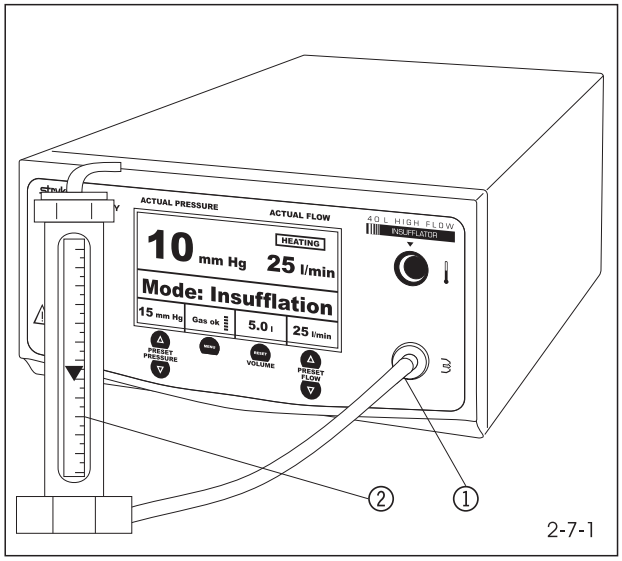



**Fig. 2-7-1: Test Layout: Flow Volume**

① Tube Connection
② Flow Column (40 l/min)

1. Attach a tube and a flow column to insufflation tube connection (Fig. 2-6-1).
2. Turn on device.
3. Set a nominal pressure of 15 mm Hg.
4. Press the Start/Stop key.
5. Check flow volume of device in gas flow levels 2 and 3. The value of the nominal flow indicator may not exceed a tolerance of ±2,0 l/min.
   The flow column value is not to be considered until after gas flow fluctuations have stabilized.
6. Press the Start/Stop key to end test.
7. Remove all measuring tools and resources.

**Adjustment**

- Service menu option "Flow Calibration."

## 2-8 Testing Overpressure Alarm

1. Attach a tube and an air-filled syringe to insufflation tube connection (Fig. 2-5-1).
2. Use the syringe to slowly generate a pressure of 15 mm Hg.
3. Slowly increase pressure to 21 mm Hg and press the Start/ Stop key.
4. An alarm is sounded after approx. 5 seconds and “Overpressure” is displayed.
5. Select gas flow level 2.
6. The bleeder (relief) system is activated after approx. 5 seconds (time and pressure value can be changed in the user menu).
7. The bleeder system relieves the pressure; alarm and “Overpressure” warning symbol are turned off.
8. Press the Start/Stop key and remove test tools and resources.

**Adjustment**

- Replace low-pressure unit.

## 2-9 Testing Blockage Alarm

1. Connect insufflation tube and close off the end of the tube.
2. Press the Start/Stop key.
3. An alarm is sounded after approx. 5 seconds and “Blockage” is displayed. The acoustic warning signal can be deactivated in the user menu.
4. Open the insufflation tube connection; the alarm is turned off.
5. Press the Start/Stop key.

**Adjustment**

- Return device to factory.

## 2-10 Testing Gas Heater

1. Connect a heater tube to insufflation tube and gas heater connection.
2. The display depicts “HEATING.” The tube is being pre-warmed.
3. Unplug the gas heater. The display “HEATING” disappears.
4. Remove heater tube.
5. Turn off device.

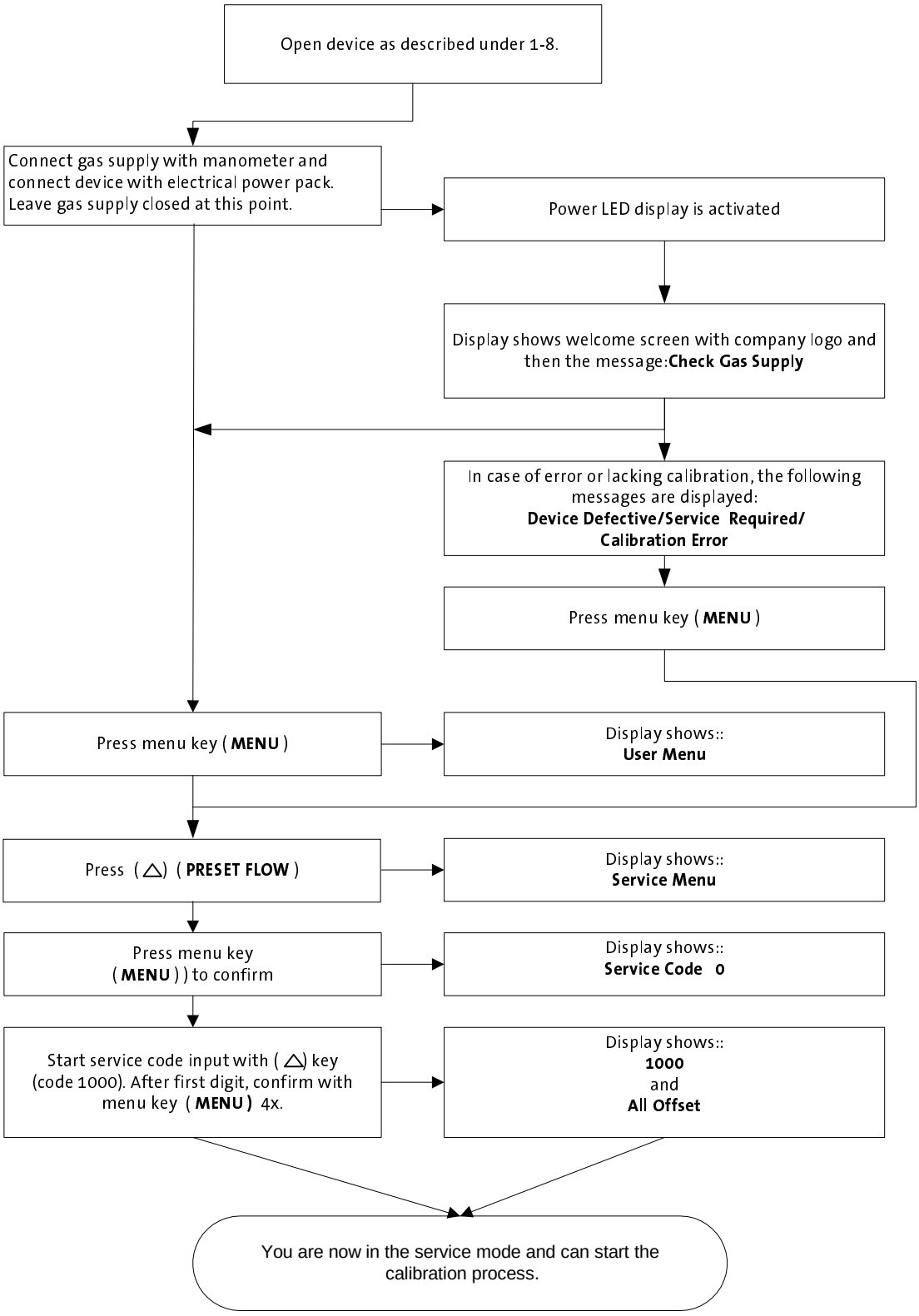
**Adjustment**

- Replace HPL board or cable to HPL.

# 3 Service Menu

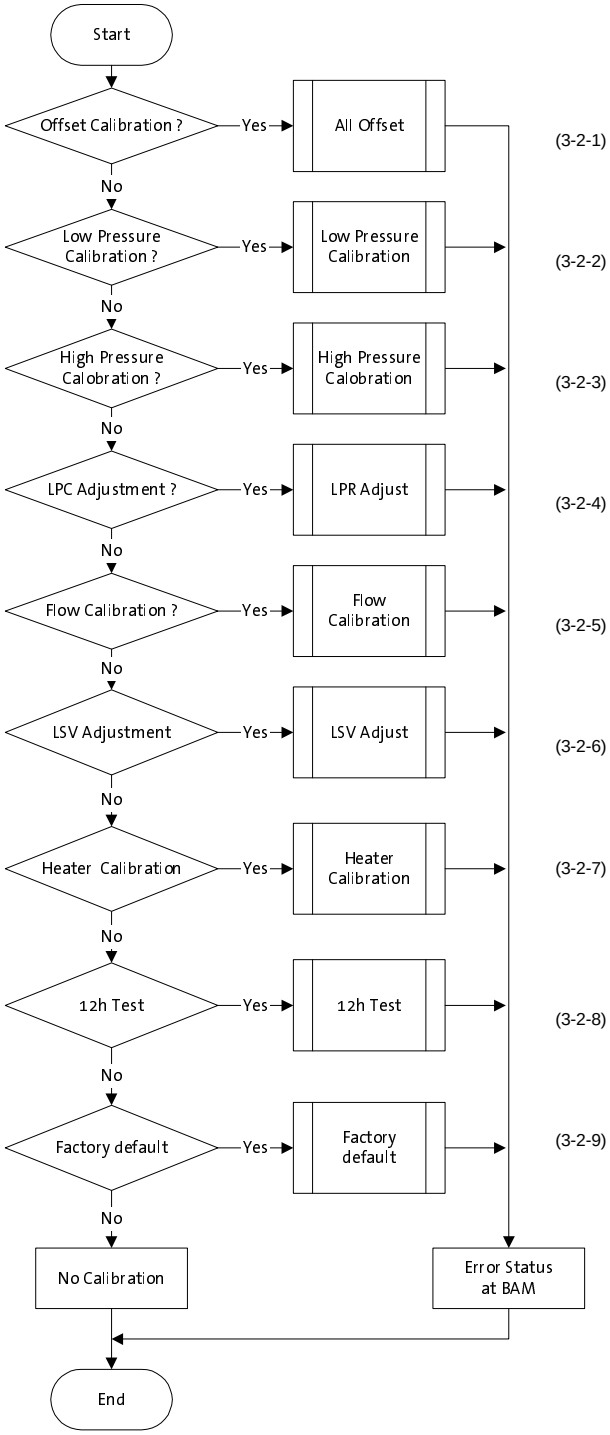
## 3-1 Opening the Service Menu

- Device parameters are displayed and changed in the service menu.
- Menu options are to be carried out in sequence to avoid malfunctions.
- Use the keys below the display for input.
- The function of each key is displayed above.
- Confirm input (Enter) with the (MENU) key.
- Use the (**RESET**) key to exit current menu level (Esc) and to return to the previous level.


Open device as described under 1-8.
Connect gas supply with manometer and connect device with electrical power pack. Leave gas supply closed at this point.
Power LED display is activated
Display shows welcome screen with company logo and then the message:Check Gas Supply
In case of error or lacking calibration, the following messages are displayed:
Device Defective/Service Required/
Calibration Error
Press menu key ( MENU )
Press menu key ( MENU )
Display shows::
User Menu
Press ( △) ( PRESET FLOW )
Display shows::
Service Menu
Press menu key
( MENU ) ) to confirm
Display shows::
Service Code 0
Start service code input with ( △) key (code 1000). After first digit, confirm with menu key ( MENU ) 4x.
Display shows::
1000
and
All Offset
You are now in the service mode and can start the calibration process.

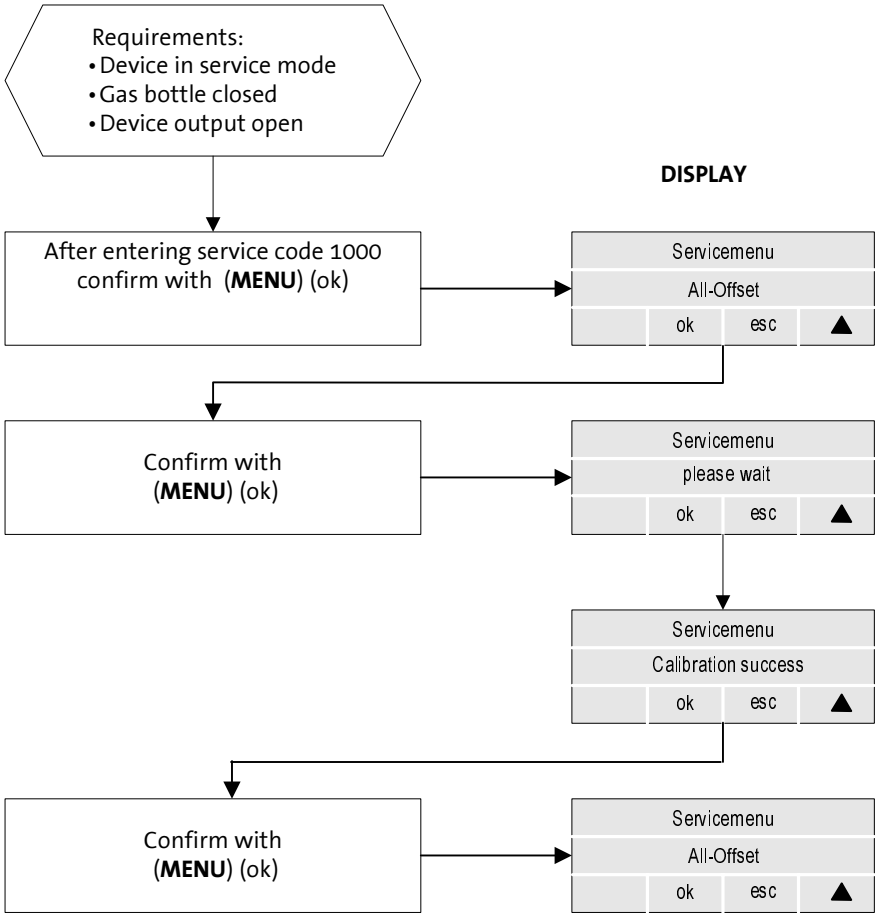
## 3-2 Calibration

The following chart provides an overview over the necessary calibrations.




- Use the keys below the display for **input**.
- The **function** of each key is displayed above.
- **Confirm** input (Enter) with the (**MENU**) key.
- Use the (**MENU**) and (△) key to open the **next menu level**.
- Use the (▽) key to open the **previous menu level**.
- Use the (**RESET**) key to **exit** current menu level (Esc).

### 3-2-1 Offset Calibration



### 3-2-2 LOW Pressure Calibration

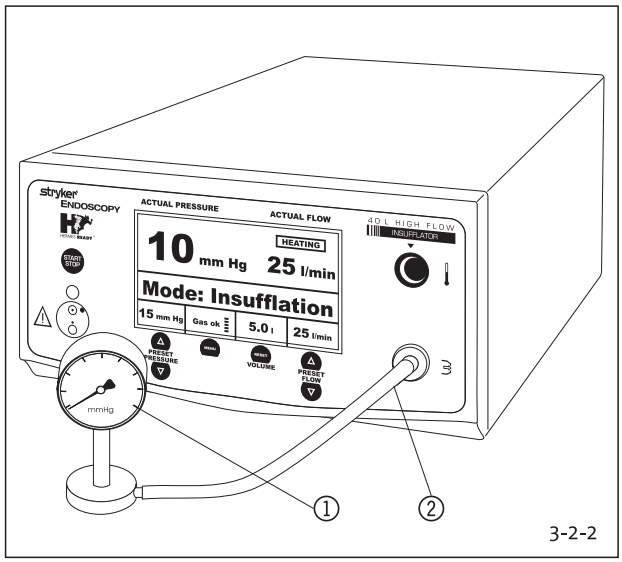
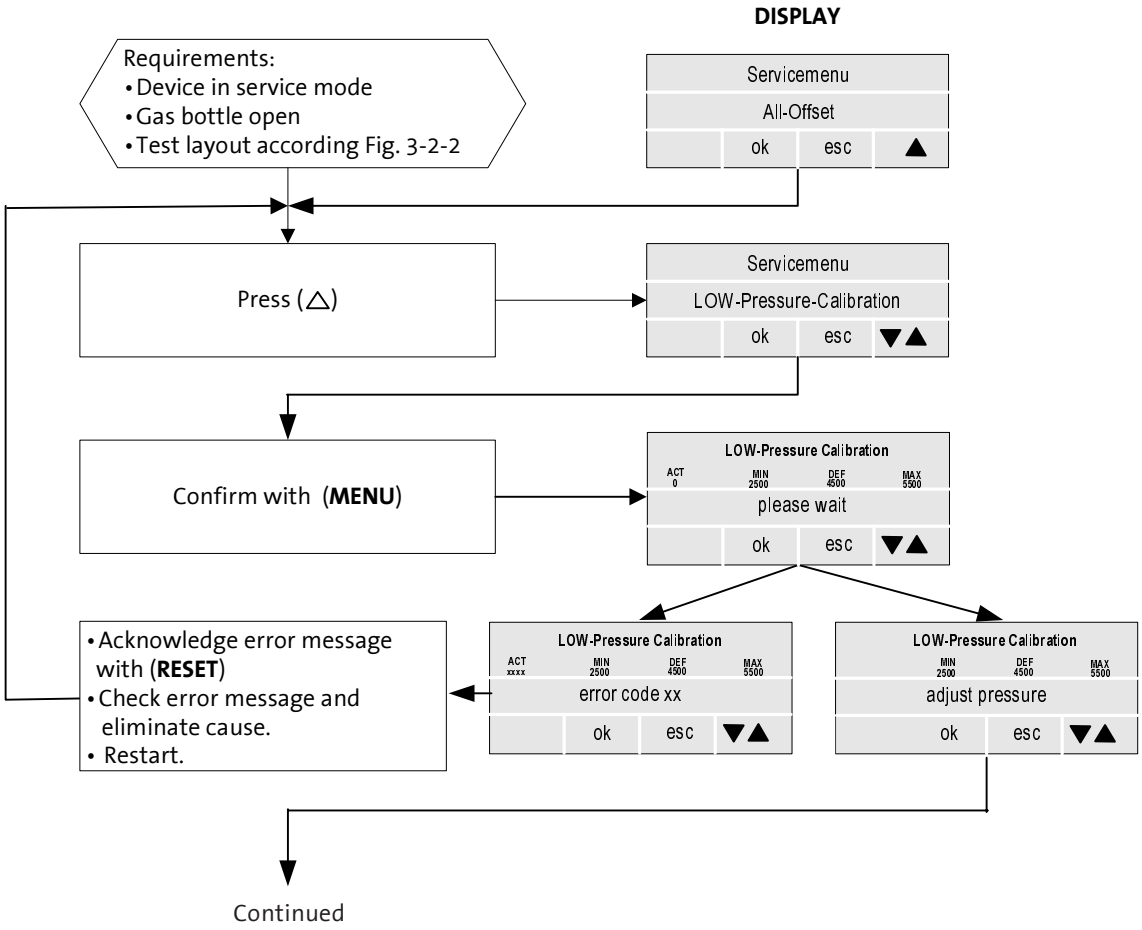
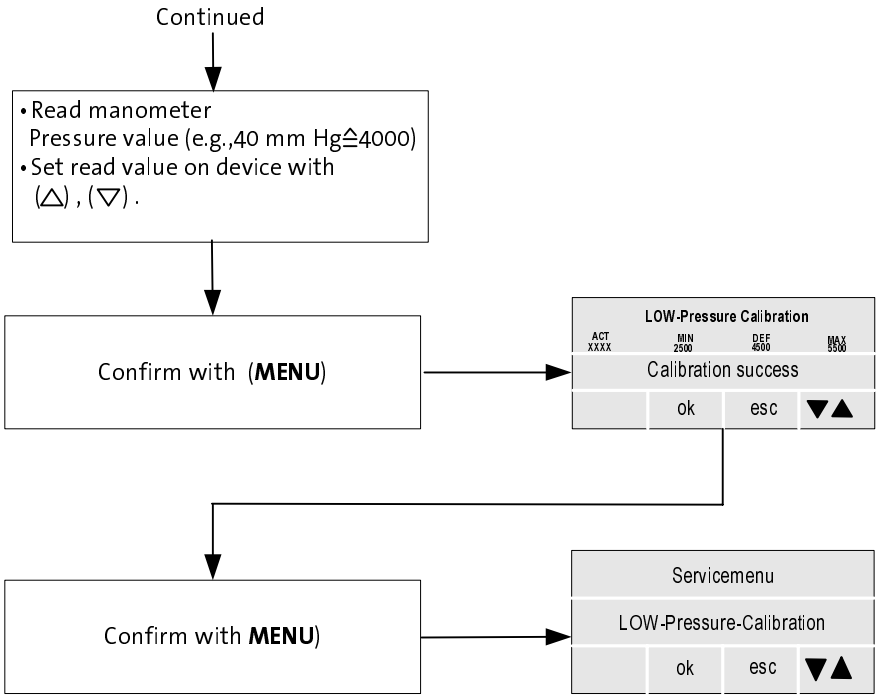



**Fig. 3-2-2: Test Layout: Low Pressure Calibration**

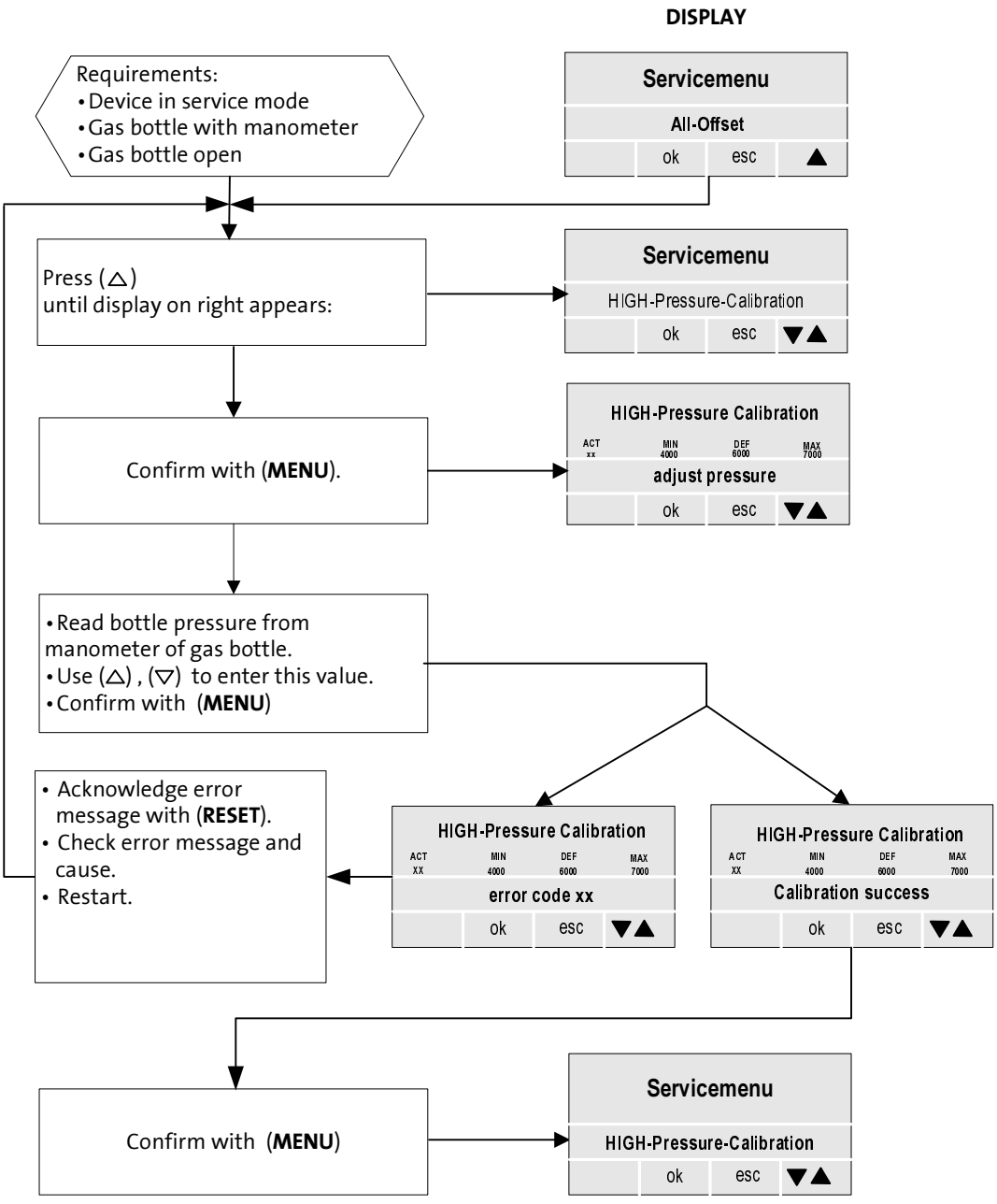
① Manometer (0-70 mm Hg)
② Device Output/Tube Connection



### 3-2-2 LOW-Pressure Calibration



### 3-2-3 HIGH Pressure Calibration



### 3-2-4 LPR Calibration

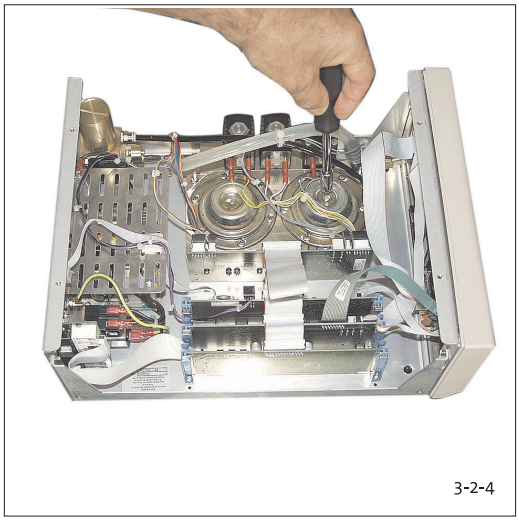
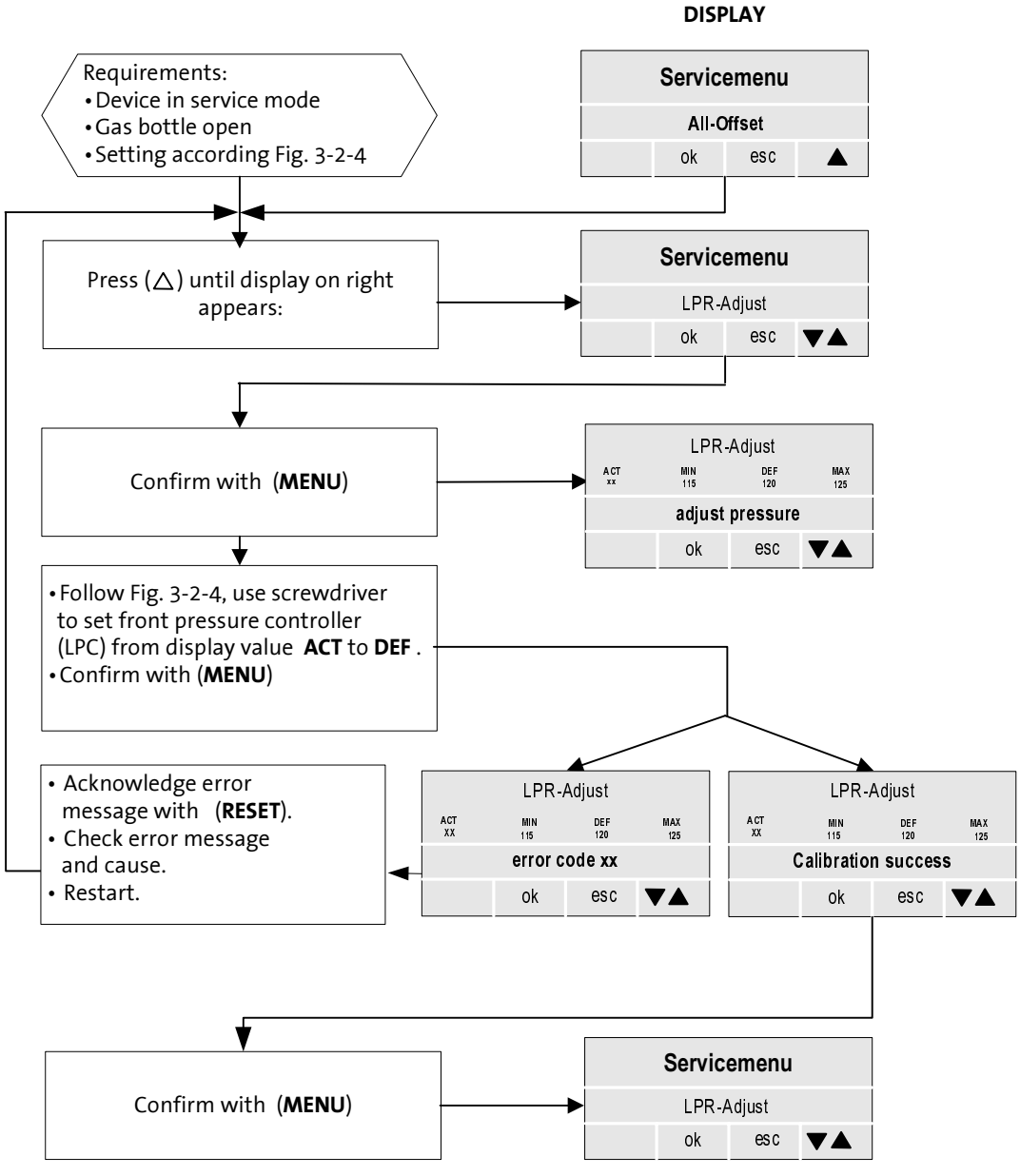



**Fig. 3-2-4: F105 Low Pressure Controller Settings**



### 3-2-5 Flow Calibration

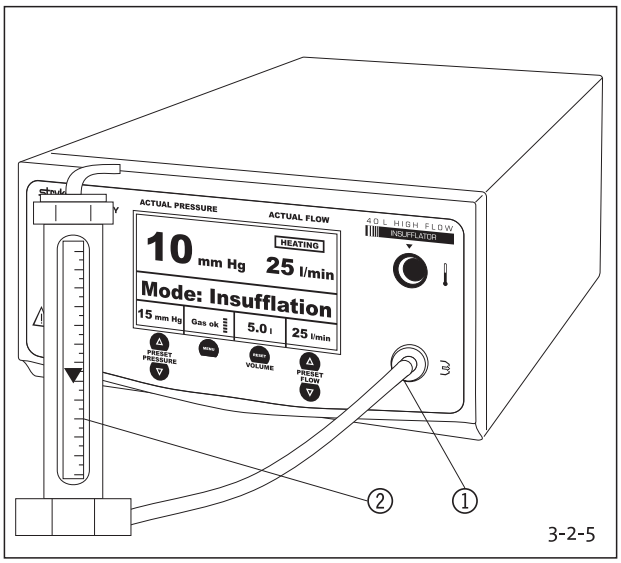
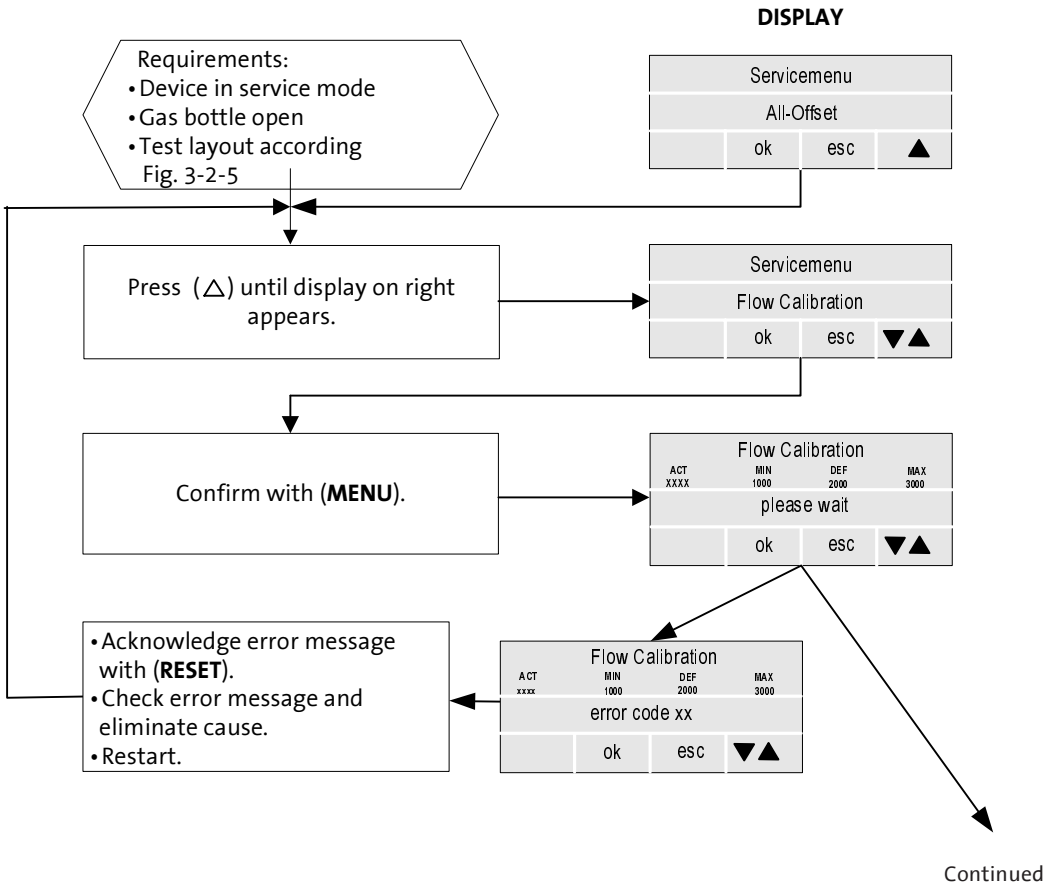


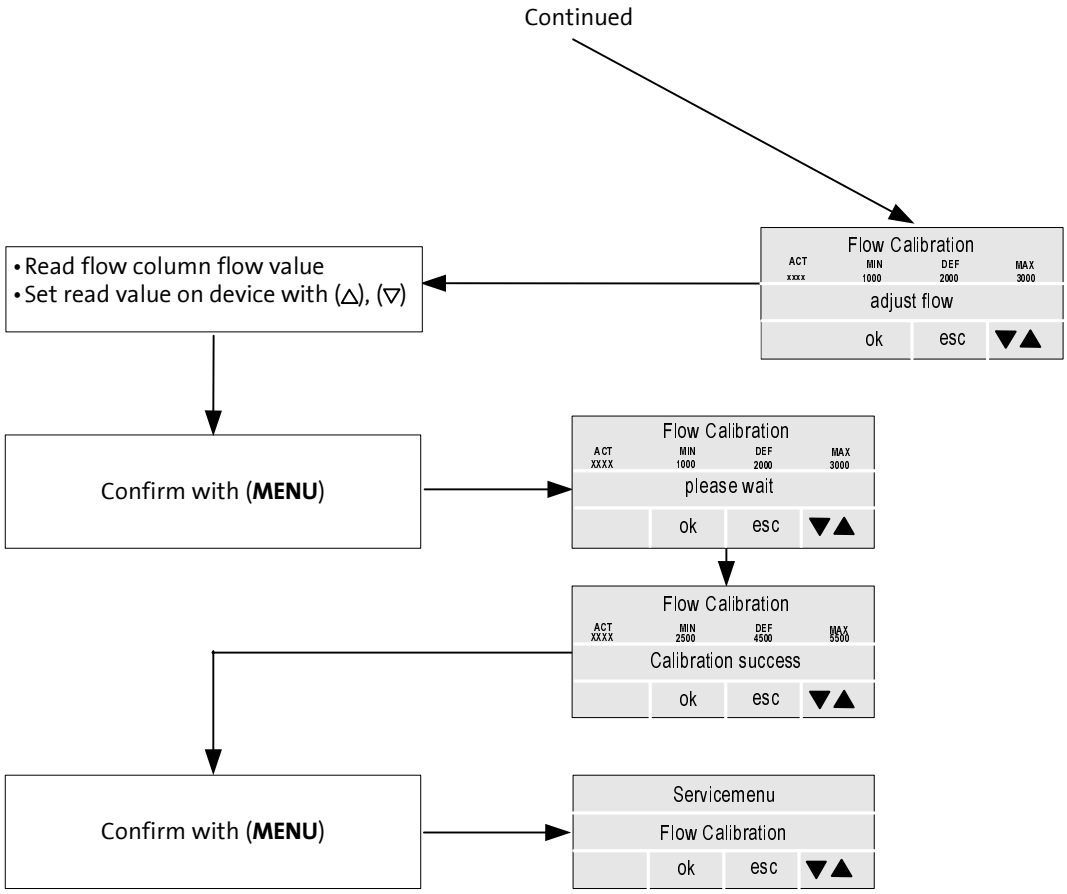

**Fig. 3-2-5: Test Layout: Flow Calibration**

① Device Output/Tube Connection
② Flow Column (40 l/min)




Continued

### 3-2-5 Flow Calibration



### 3-2-6 LSV-Calibration

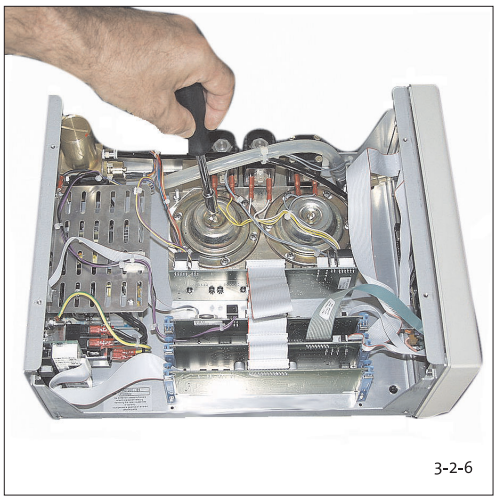
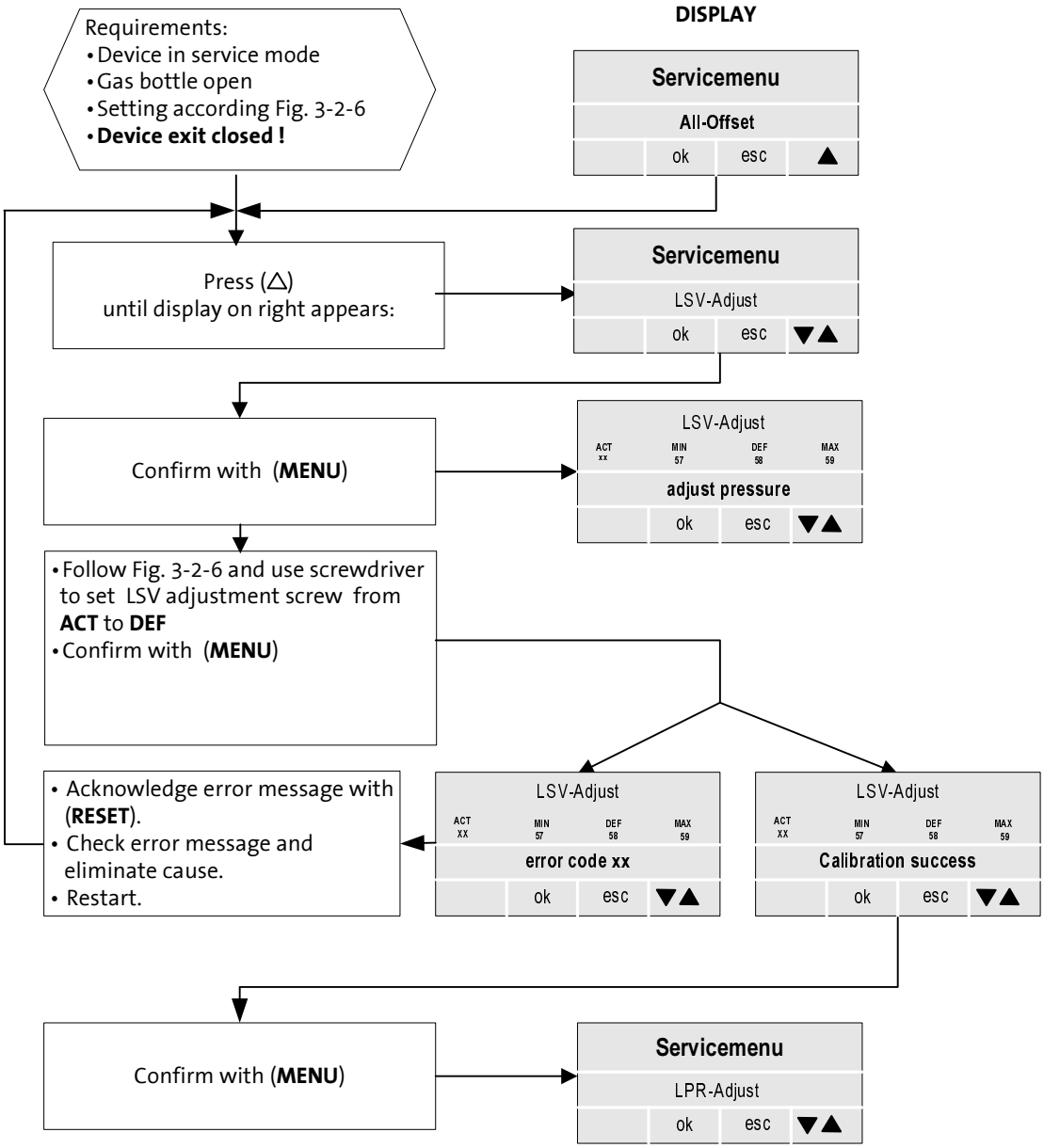



**Fig. 3-2-6: LSV Setting**



### 3-2-7 Heater Calibration

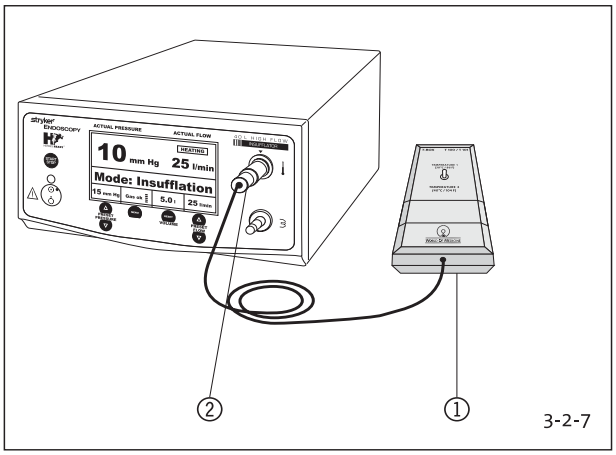
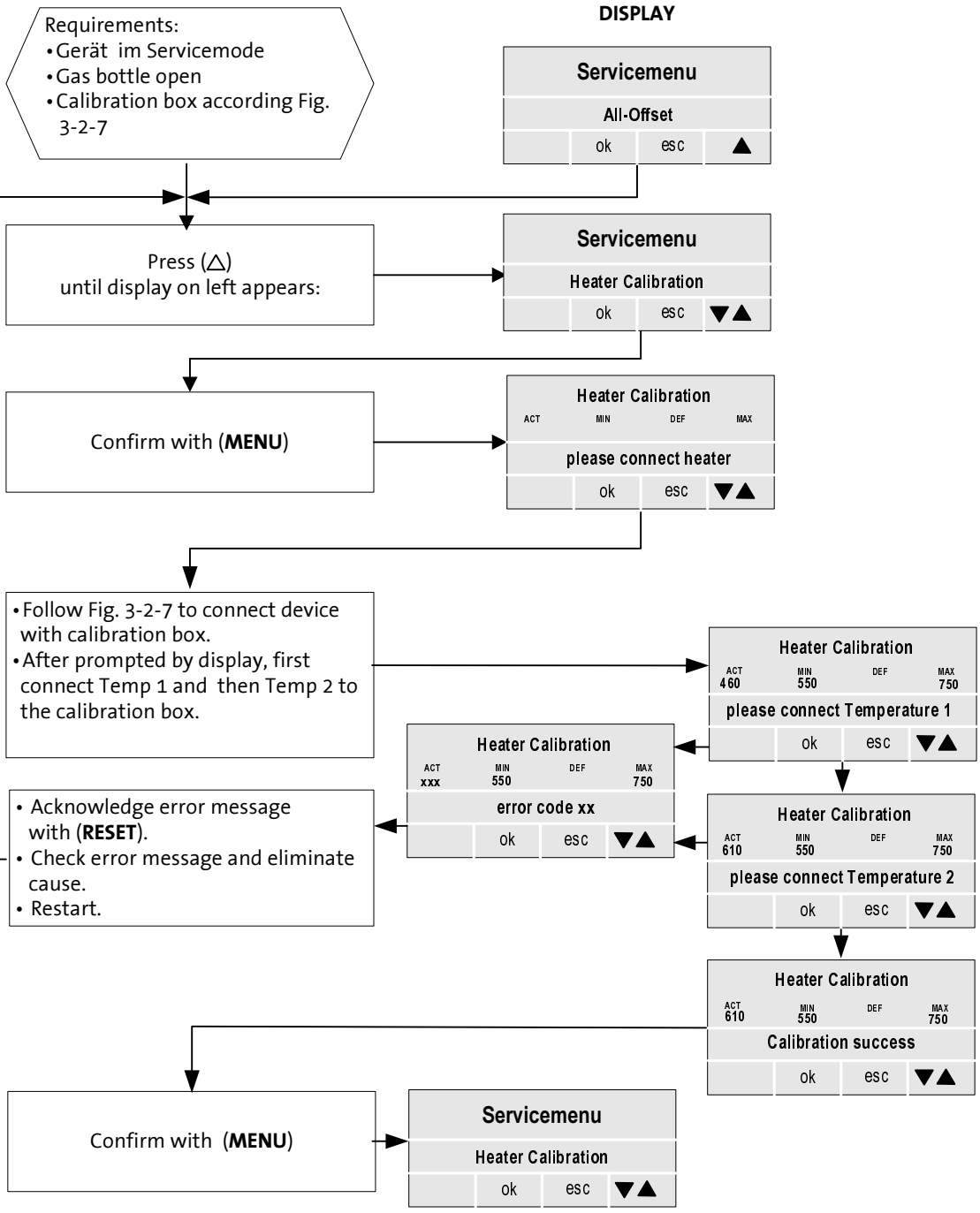


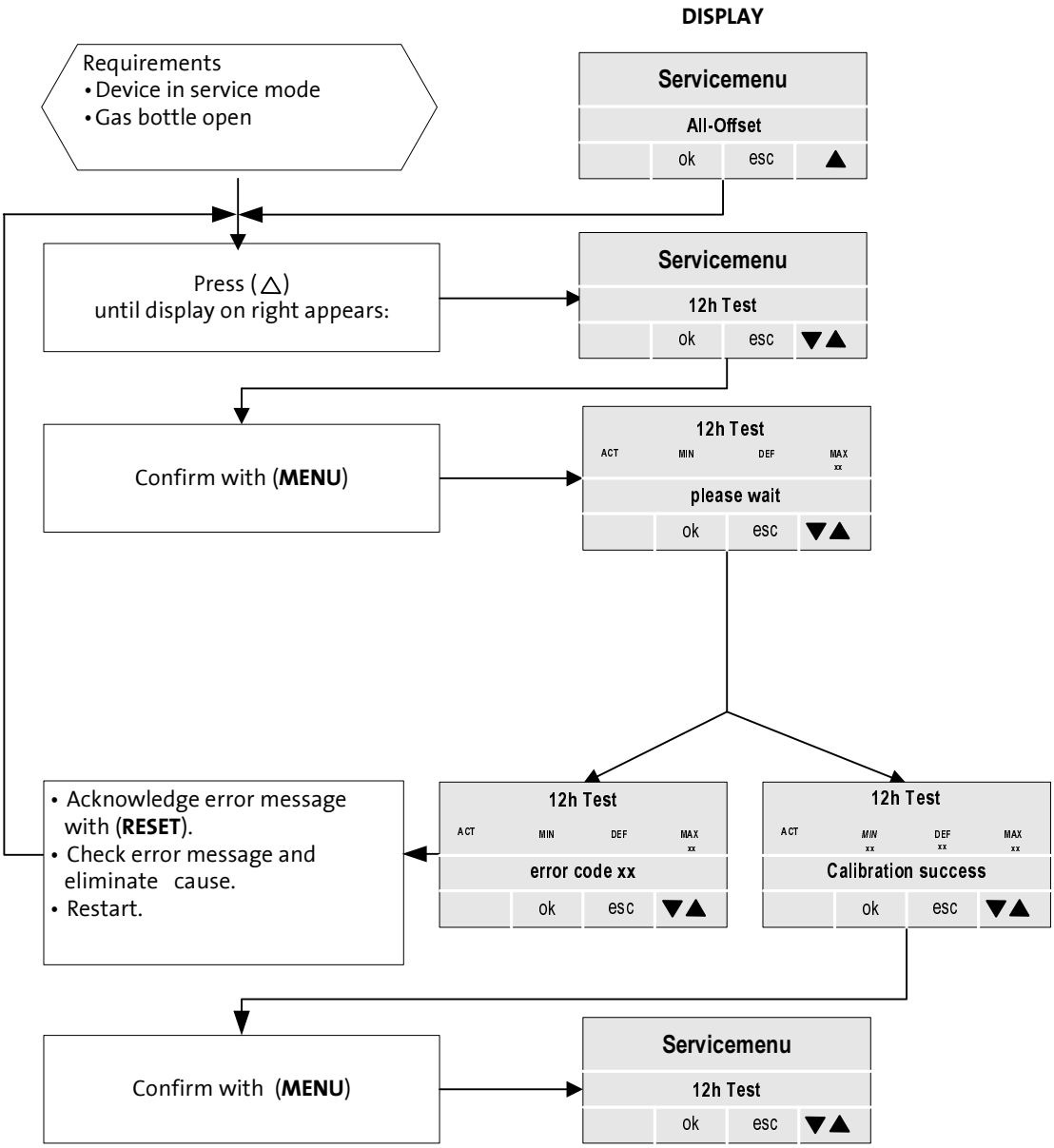

**Fig. 3-2-7: Connection for Heater Calibration Box**

① Heater Calibration Box T100/T101
② Connection for Heater Calibration Box



### 3-2-8 12h Test

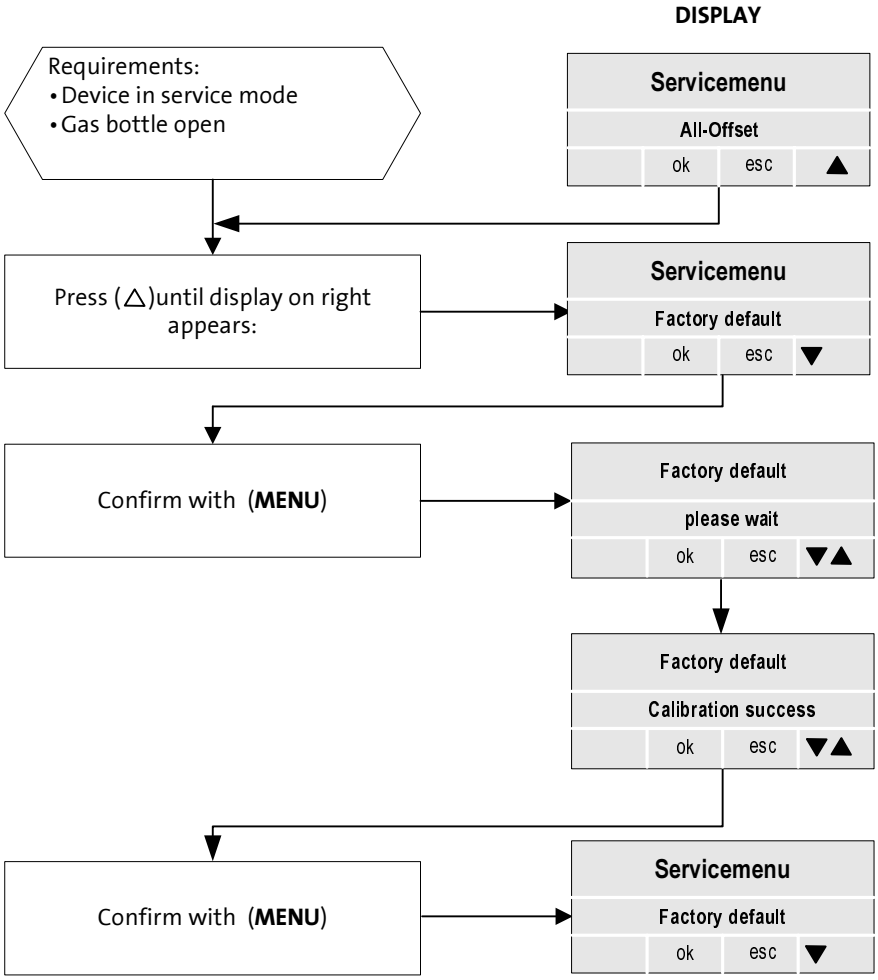
**Make sure device is continuously connected with live wire during 12 hour test and is not operated or used in any other capacity during this test.**




**Switch device off and on again after calibration is completed to avoid error messages.**

### 3-2-9 Factory Default

**Using this menu option will reset all values to the factory default settings. The device is then not calibrated and cannot be operated.**



4 Replacing Components

The following components and modules can be replaced if malfunctioning:

- Entire High Pressure Unit HPU
- Entire Power Pack
- Non-Heating Device Plug
- Basic Board Module BAM
- Video Board LCD
- Board HPL
- Entire Pneumatics Unit (Low Pressure Unit)
- Entire Set of Cables
- Insufflator Tube Set
- Entire Fluid Sensor
- Device Feet
- Entire Video Board
- Hermes Interface
- Potential Equalization Plug

The device has to be opened as described in Chapter 1-7 to replace any modules or components.

## 4-1 High Pressure Unit HPU

The high-pressure unit is connected with the gas port. The high-pressure unit consists of the following function elements:

- Pressure Controller
- High Pressure Fuse
- High Pressure Sensor

**Fig. 4-1-1: Device Rear: Gas Connection Port**

① High Pressure Unit Fastening Screws
② Gas Connection

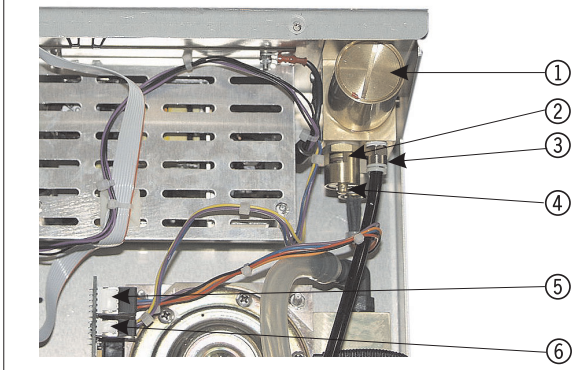



**Fig. 4-1-2: High Pressure Unit Connections**

① High Pressure Unit HPU
② High Pressure Fuse
③ Connection for Gas Tube
④ High Pressure Sensor
⑤ High Pressure Sensor Connection
⑥ Temperature Sensor Connection

Replace elements if malfunctioning and in case of causally determined flow limitation.

1. Open device as described in Chapter 1-7.
2. Remove gas connection (see Fig. 4-1-1) as described in Chapter 4-2.
3. Remove gas tube from HPU as well as the electric jumpers (see Fig. 4-1-2).
4. Unscrew the four fastening screws on rear plate and remove HPU.
5. Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. New calibration of offset and high pressure.

4 Replacing Components

## 4-2 Gas Connection

The gas connection consists of the following:

- Supply-specific connection adapter completely installed with:
- Screw Unions SW 24
- O-Ring on Face

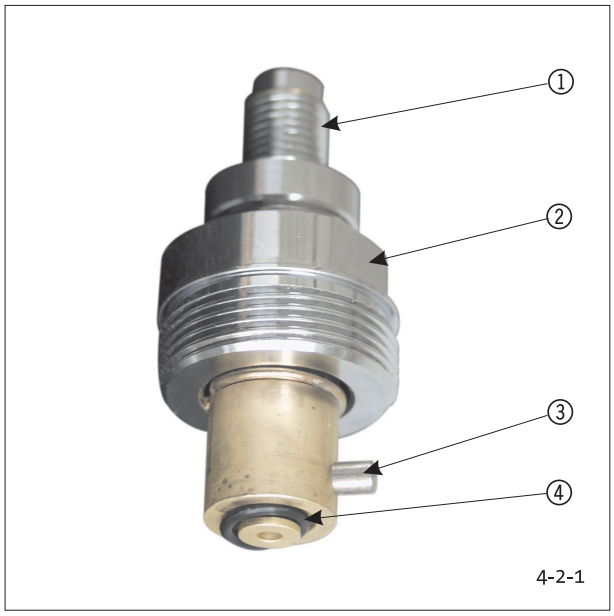



**Fig. 4-2-1: CO2 Gas Connection**

① Gas Supply Connection
② Flat SW 24
③ Anti-Twist Stop
④ O-Ring Seal

Replace elements in case of defective, non-sealing pressure connections, flow-reducing filter soiling, and if operational functionality is reduced.

1. Use SW 24 adjustable wrench to Unscrew rear plate screws.
2. Make sure O-ring remains in place when removing component.
3. Reverse instructions to install elements. **Make sure anti-twist stop is properly inserted when replacing gas connection!**

Conduct the following tests after replacing modules or components:

1. High pressure level test (Item 2-3).
2. Flow volume test (Chapter 2-6).

## 4-3 Low Pressure Unit LPU

Replace elements if malfunctioning and in case of flow limitation.

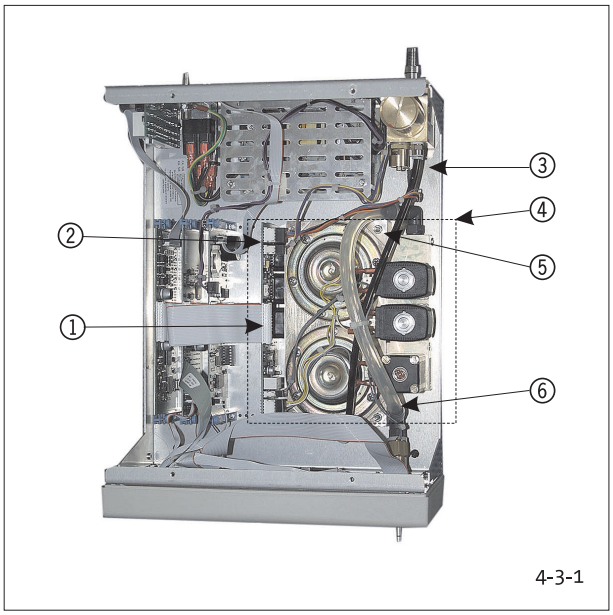



**Fig. 4-3-1: Position LPU**

① Flat Cable/Plug-in Connection
② Electrical Plug-in Connection with High Pressure Unit
③ Tube Connection with HPU
④ Complete LPU
⑤ SW 7 Nut / Tooth Lock Washer (4x)
⑥ Connection Tube

1. Remove the connection tube from the LPU ③⑥ .
2. Unscrew the plug-in connections for the electronic plugs ①② .
3. Unscrew four fastening nuts ⑤ at base case of pneumatics unit; remove the tooth lock washers, and lift out the entire LPU complete with block, valves, and board.

Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. Calibration according to Chapters 3-2-1 to 3-2-6 and Chapter 3-2-8.

4 Replacing Components

## 4-4 Power Pack

Replace power pack if malfunctioning and in case of repeated safety defect.

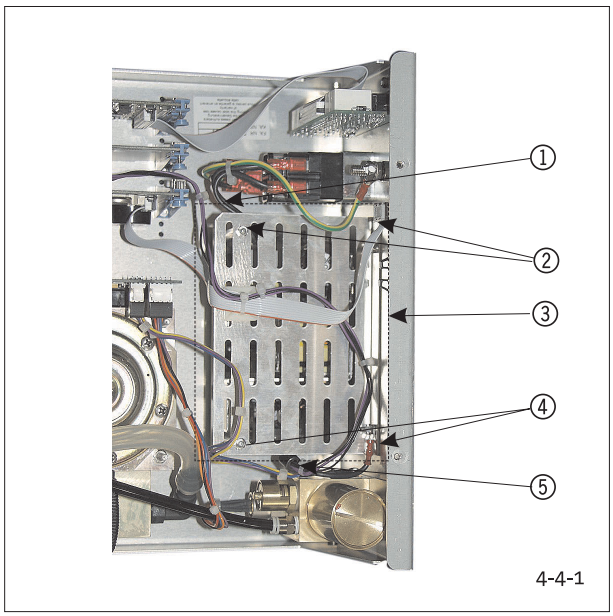



**Fig. 4-4-1: Position Power Pack**

① Voltage Input Cable/Plug-in Connection
② Fastening Nuts/Tooth Lock Washers for Cover
③ Entire Power Pack
④ Fastening Nuts/Tooth Lock Washers for Cover
⑤ Voltage Output Cable/Plug-in Connection

1. Remove the electrical plug-in connectors ① ⑤ .
2. Use SW 5.5 adjustable wrench to Unscrew four fastening nuts ② ④ on cover and remove cover.
3. Unscrew two bolt screws on front of power pack board and two nuts in rear and lift power pack from case.

Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. Use a multimeter to check voltage at input and output of power pack.
2. Switch on device and perform function check.
3. Safety test according to Chapter 2-1.

## 4-5 Non-Heating Device Plug

Replace non-heating device plug if malfunctioning and in case of defects.

The non-heating plug is available as a complete kit including screws, cables with plugs, and fuse holder with fuse.

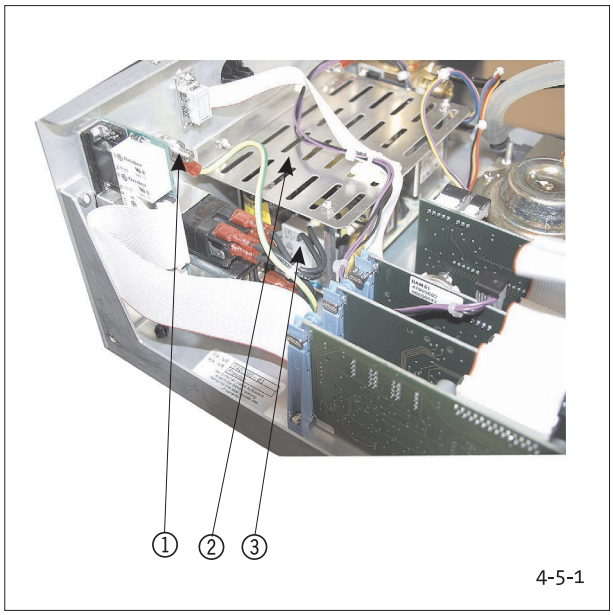



**Fig. 4-5-1: Position Non-Heating Device Plug**

① Bolt Screw for Mass Connection/Potential Equalization Line
② Power Pack
③ Power Pack Connector Plug

1. (Fig. 4-5-1) Unscrew PE connection ① .
2. Remove plug-in connector at cable of non-heating device plug of power pack ② by pulling towards top.
3. (Fig. 4-5-2) Unscrew two fastening screws ① at rear plate and remove non-heating device plug by pulling towards rear.
4. Reverse instructions to install elements.

4 Replacing Components

**Fig. 4-5-2: Non-Heating Device Mounting Screws**

① Non-Heating Device Mounting Screws

Conduct the following test after replacing modules or components:

1. Switch on device and perform function check.
3. Safety test according to Chapter 2-1.

## 4-6 Panel Board (ON/OFF Key)

Replace panel board or remote control if malfunctioning ON/OFF key.

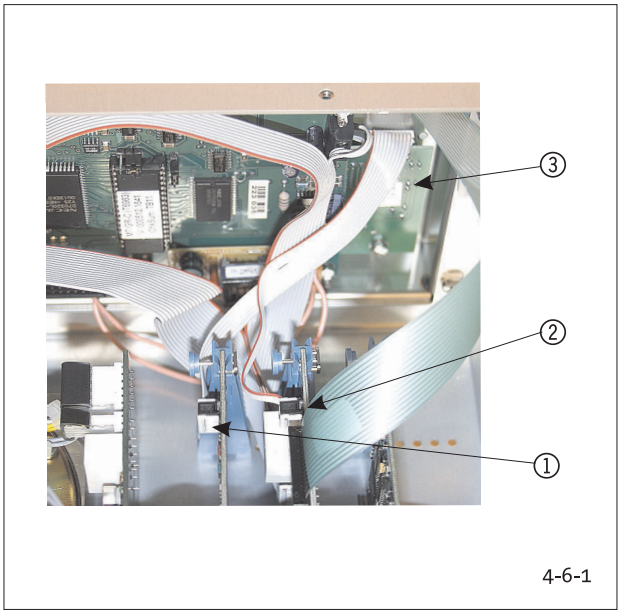



**Fig. 4-6-1: Position Panel Board (ON/OFF Key)**

① Plug-in Connector to Basic Module BAM 01
② Plug-in Connector to I/O Module IOM 01
③ Panel Board

1. Remove the electrical plug-in connectors ① ② ..
2. Unscrew two nuts and washers ③ .
3. Remove board.

Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. Remote control test, installation check, function test, display.
2. Safety test, Chapter 2-1.

4 Replacing Components

## 4-7 Modules/Boards

Replace the respective board in case of malfunction or defect.

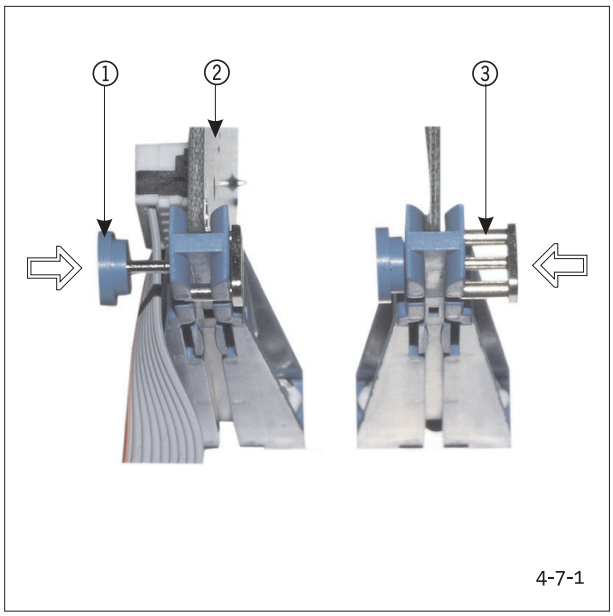



**Fig. 4-7-1: Component Boards-/Module Release**

① Locked position-> Press to release
② Component Board/Module
③ Released position-> Press to lock

1. Remove the electrical plug-in connectors from the component boards/modules.
2. Firmly grasp component board/module and press button ① to release.
3. Reverse instructions to install elements.
4. Lock component board/module ->Position ① .

Conduct the following test after replacing modules or components:

Function test of replaced components.

## 4-8 Video Board/LCD

Replace video board if malfunctioning and in case of defects.

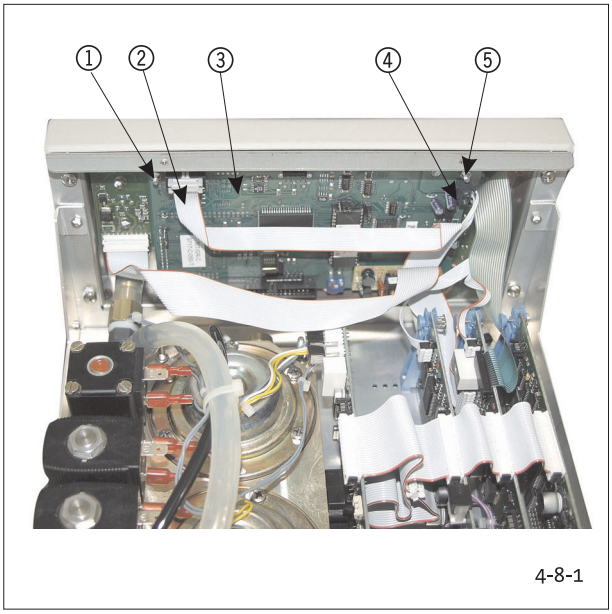



**Fig. 4-8-1: Position Video Board/LCD**

① Fastening Nut/Tooth Lock Washer
② Plug-in Connector from I/O Module
③ Video Module DIU
④ Terminal Screw for Cable from I/O Board
⑤ Fastening Nut/Tooth Lock Washer

The video board and the LCD can be removed without first having to disassemble other components. However, access to the video board is much easier if the front panel has been removed (see Chapter 4-12).

A SW 5.5 fork wrench/ring wrench and a small screwdriver are required for the removal of the video board.

Be careful not to damage any cables or other components when removing the video board.

1. Remove the cable connectors ② ④ .
2. (4x) Unscrew the fastening nuts ① ⑤ and tooth lock washers at the corners of the video board ③ .
3. Watch out for the distance sleeves between video board and LCD when removing the video board together with the LCD from the bolt screws.

Reverse instructions to install elements.

Conduct the following test after replacing modules or components:

1. Function test of LCD display.

4 Replacing Components

## 4-9 Heater Board HB

Replace heater board if malfunctioning or in case of gas heater tube defects.

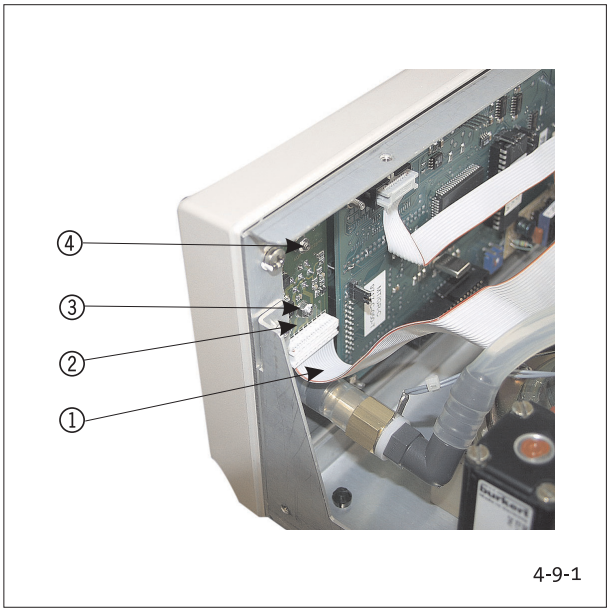



**Fig. 4-9-1: Position Heater Board**

① Connecting Cable to I/O Module IOM
② Heater Board HB
③ Nut/Tooth Lock Washer for Fastening
④ Nut/Tooth Lock Washer for Fastening

The heater board can be removed without first having to disassemble other components.

1. Unscrew fastening nuts and tooth lock washers ③ ④ .
2. Remove board ② together with the connecting cable ① from bolt screws by pulling towards rear.
3. Remove cable connector from heater board.

Reverse instructions to install elements.

Conduct the following test after replacing modules or components:

1. Heater function test ( Chapter 2-9).

## 4-10 Insufflation Tube Connection (Gas Outlet)

Replace if surface shows defects that allow leaks.

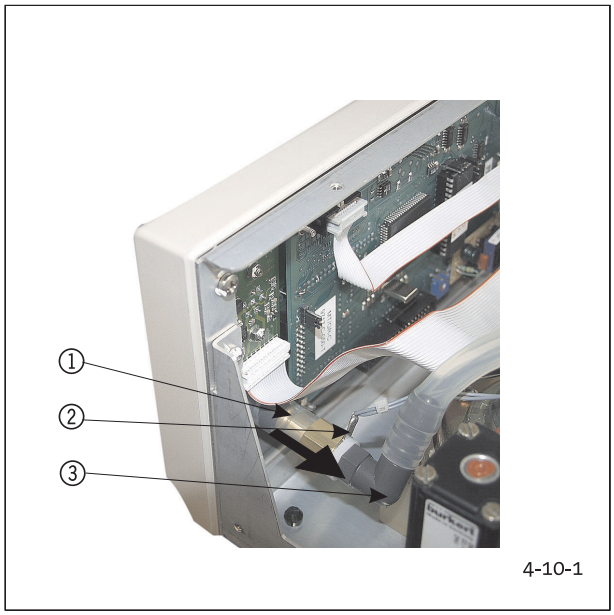



**Fig. 4-10-1: Position Insufflation Tube Connection**

① Fluid Sensor (FLS)
② Fluid Sensor Electrical Connection
③ L-Shaped Adapter from Fluid Sensor

1. Remove connecting cables and front panel (see Fig. 4-12).
2. Carefully remove the FLS ① together with the L-shaped adapter ③ .
3. Use a SW 19 adjustable wrench to unscrew inner lock nut from gas outlet.
4. Remove locknut and lock washer.
5. Pull gas outlet towards front and remove.

Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. Leak test according to Chapter 2-5.
2. Safety test, Chapter 2-1.

## 4-11 Fluid Sensor

Replace if malfunctioning.

The electrical connector of the fluid sensor

(Fig. 4-10-1, ② ) is integrated into the connecting adapter between insufflation tube connection and pneumatic unit.

If necessary, replace the entire connecting adapter.

1. Remove cable from the cable connector.
2. Detach tube connection as described in Chapter 4-10.

Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. Leak test according to Chapter 2-5.
2. Safety test according to Chapter 2-1.

## 4-12 Front Panel

Replace front panel or operating key if either are damaged or a front panel malfunction occurs.

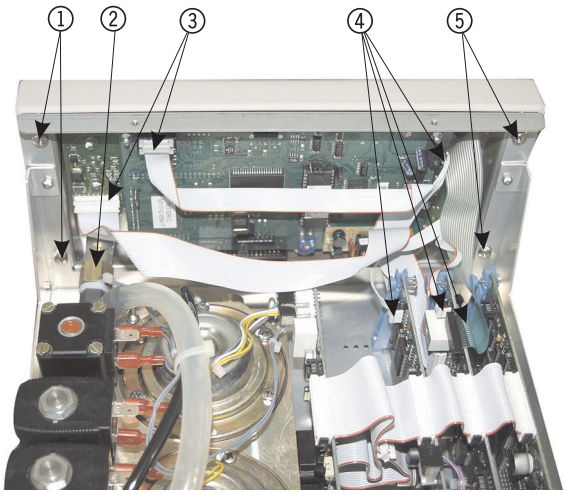



**Fig. 4-12-1: Fastening Front Panel**

① Mounting Screws
② Insufflation Tube Connection
③ Plug-in Connection
④ Plug-in Connection
⑤ Mounting Screws

1. Remove the electrical plug-in connectors ③④.
2. Unscrew 2 cross-recessed screws ①⑤ on the left and right.
3. Remove tube connection to the insufflation tube connector.
4. Carefully remove front panel by pulling towards front.
5. Detach elements attached to the inside of the front panel.

Reverse instructions to install elements.

Conduct the following tests after replacing modules or components:

1. Function test of replaced components.
2. Safety test according to Chapter 2-1.

# 5 Spare Parts List

| Artikelnummer | Description |
|---|---|
| 200-3432-X | Compl. High Pressure Unit |
| 200-1057-X | Compl. Power Pack |
| 41-00096-1X | Non-Heating Device Plug |
| 200-1055-X | Basic Board Module |
| 200-1054-X | Input/Output Board Module |
| 200-0811-X | LCD Board / Display |
| 200-3400-X | Panel Board |
| 200-3399-X | Gas Heater Board |
| 200-3401-X | Compl. Pneumatics Unit (Low Pressure Unit) |
| 200-3393-X | Compl. Set of Insufflator Cables |
| 46-10027-1X | Insufflator Tube Set |
| 200-4443-X | Tube Connection F105 6/8 |
| 200-3392-X | Case Cover |
| 200-3397-X | Front Panel |
| 200-3406-X | Compl. Fluid Sensor |
| 16-00002-1X | Device Castors |
| 200-3409-X | Compl. Video Board |
| 200-3440-X | Hermes Interface |
| 46-00054-1X | Potential Equalization Plug |

# 6 Calibration Error Messages

***To troubleshoot check connections and settings first and then repeat the calibration process before replacing a component or component group.**

| Error Message | Cause | Troubleshooting |
|---|---|---|
| 0 | General error | Replace LPU |
| 1 | Timeout | Replace LPU |
| 2 | General software error | Replace LPU |
| 3 | EEprom write error | Replace LPU |
| 4 | General gas supply error | Check gas supply |
| | | |
| 10 | General offset calibration error | Replace LPU |
| 11 | Offset Low pressure regulator too low | Replace LPU |
| 12 | Offset Low pressure sensor too low | Replace LPU |
| 13 | Offset Safety pressure sensor too low | Replace LPU |
| 14 | Offset Differential pressure sensor too low | Replace LPU |
| 15 | Offset High pressure sensor too low | Replace LPU |
| 16 | Offset Temperature sensor too low | Replace LPU |
| 17 | Offset Current monitoring of high pressure gas heater too low | Replace LPU |
| 18 | Offset Gas heater too low | Replace LPU |
| 19 | Offset Low pressure regulator too high | Replace LPU |
| 20 | Offset Low pressure sensor too high | Replace LPU |
| 21 | Offset Safety pressure sensor too high | Replace LPU |
| 22 | Offset Differential pressure sensor too high | Replace LPU |
| 23 | Offset High pressure sensor too high | Replace LPU |
| 24 | Offset Temperature sensor too high | Replace LPU |
| 25 | Offset Current monitoring of high pressure gas heater too high | Replace LPU |
| 26 | Offset Gas heater too high | Replace LPU |
| | | |
| 50 | General low pressure calibration error | Check FIS |
| 51 | Low pressure - large leak | Check manometer connection |
| 52 | Low pressure - small leak | Check manometer connection |
| 53 | Low pressure intake value too low | Check gas supply, HPU |
| 54 | Low pressure intake value too high | Check gas supply, calibrate LPR |
| 55 | Amplification I - Low pressure | Replace LPU |
| 56 | Amplification I - Low pressure sensor too high | Replace LPU |
| 57 | Amplification II - Low pressure sensor too low | Replace LPU |
| 58 | Amplification II - Low pressure sensor too high | Replace LPU |
| 59 | Amplification - Safety pressure sensor too low | Replace LPU |
| 60 | Low pressure amplification - Safety pressure sensor too high | Replace LPU |

# 6 Calibration Error Messages

*** To troubleshoot check connections and settings first and then repeat the calibration process before replacing a component or component group.**

| Error and Warning Messages | Cause | Troubleshooting |
|---|---|---|
| 70 | General High Pressure Calibration Error | Replace HPU |
| 73 | High pressure intake value too low | Check gas supply |
| 74 | High pressure intake value too high | Check gas supply |
| 75 | High pressure sensor value has changed | Check gas supply |
| 76 | High pressure sensor amplification too low | Replace HPU |
| 77 | High pressure sensor amplification too high | Replace HPU |
| | | |
| 90 | General low pressure regulator calibration error | Replace LPU |
| 91 | Adjustment - Low pressure regulator not in range | Repeat calibration |
| | | |
| 110 | Low pressure safety calibration error | Check flow meter, replace LPU |
| 111 | Adjustment - Low pressure safety not in range | Repeat calibration |
| | | |
| 130 | Flow | Check flow meter, replace LPU |
| 131 | Flow resistance too high | Check flow meter, replace LPU |
| 132 | | |
| 133 | Flow intake value too low | Replace LPU |
| 134 | Flow intake value too high | Replace LPU |
| 135 | Flow sensor value changed | Replace LPU |
| 136 | Amplification - Flow sensor too low | Replace LPU |
| 137 | Amplification - Flow sensor too high | Replace LPU |
| 138 | Offset Proportional valve too low | Replace LPU |
| 139 | Offset Proportional valve too high | Replace LPU |
| 140 | Hysteresis - Proportional valve too low | Replace LPU |
| 141 | Hysteresis - Proportional valve too high | Replace LPU |
| 142 | Amplification - Proportional valve too low | Replace LPU |
| 143 | Amplification - Proportional valve too high | Replace LPU |
| 144 | Sticky proportional valve | Replace LPU |

# 7 Technical Data

| | |
|---|---|
| Power Supply | 100 -240 V~<br>Main Fuse T 3,15 A<br>USA 3,15 A (slow blow), UL-recocnized<br>220-240 V~<br>Main Fuse T 3,15 A, UL-recocnized<br>Connection for potential equalization |
| Frequency | 50-60 Hz |
| Max. Power Consumtion | 130 /150*W |
| Max. Current | 100 V: 1250/1400 *mA<br>240 V: 540/620* mA |
| Protection Class | I, Typ BF, IP41 |
| Dimensions | Width x Height x Depth<br>273 x 145 x 360 [mm]<br>10,75x5,7x14,2 [inch] |
| Weight | Approx. 7 kg |
| Operation Conditions | 10-40 °C / 50-104 °F<br>30-75 % rel. air humedity |
| Storage and Transportation Directions | -40 - +70 °C /40 - +158°F<br>10-85 % rel. air humedity<br>85-100% rel. air humedity (14 days) |
| Manufactured and Tested acc. to | EN 60601-1 / IEC 601-1 |
| EMV | EN 60601-1-2 / IEC 601-1-2 |
| CE | 93/42/ EWG |
| Insufflation medium | Medical $CO_2$ |
| Maximun output pressure | 55 mm Hg |
| Maximun gas supply pressure | 80 bar/1160 PSI |
| Minimum gas supply pressure | 5 bar/73,3 PSI |
| Measurement range of gas supply | 0-50 bar/0-725 PSI |
| Maximun gas flow | refer to device data plate located on rear of the device |
| Pressure range | 1-30 mm Hg |
| Accuracy of pressure measurement | ±5 % |
| Accuracy of gas flow measurement | ±5 % |
| Accuracy of volume measuremant | ±10 % |
| Accuracy of gas supply measurement | ±10 % |
| Conections (optional) | Video S-VHS IN/OUT<br>Video FBAS IN/OUT<br>Video RGB IN/OUT<br>RS232 Service Interface |

* with reusable haeting tube

# 8 Glossary

| Term | Explanation |
|---|---|
| ADC | Analog/Digital Converter |
| BAM | Basic Module |
| DIU | Display Unit |
| DPS | Differential Pressure Sensor |
| EPx | Electrical Connection |
| FLS | Fluid Sensor |
| HIF | Hermes Interface |
| HPH | High Pressure Heater |
| HTS | High Pressure Temperature Sensor |
| HB | Heater Board |
| HPR | High Pressure Regulator |
| HPS | High Pressure Sensor |
| HPT | High Pressure Tube |
| HPU | High Pressure Unit |
| HPS | High Pressure Sensor |
| IFM | Interface Module |
| IOM | Input/Output Module |
| KEY | Plastic foil keyboard |
| LPT | Low Pressure Tube |
| LPR | Low Pressure Regulator |
| LPU | Low Pressure Unit |
| LSV | Low Pressure Safety Valve |
| MSA | Measuring Signal Amplifier |
| MPT | Median Pressure Tube |
| MSV | Median Pressure Safety Valve |
| OLV | Output Line Valve |
| PBU | Pneumatic Base Unit |
| PCU | Pneumatic Control Unit |
| PMS | Pressure Measuring Sensor |
| PRM | Pressure Regulator Module |
| PNB | Pneumatic Block |
| PRV | Proportional Valve |
| PSM | Power Supply Module |
| RCB | Remote Control Board |
| SPS | Safety Pressure Sensor |
| SRV | Service interface |
| NTS | Nominal Temperatur Sensor |
| VAC | Valve Controls |
| VEV | Vent Exit Valve |
| VIM | Video Module |

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## 10 Maintenance- and Checklist

Type of device:: _____ Device no.: _____

Location of use:: _____

Maintenance date: _____ Inspected by: _____ Company: _____

I. Safety Test (chap. 2-1)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Main fuse | ☐ | Incriptions | ☐ | Mechanical Condition | ☐ | Cleanliness | ☐ |
| Plug connections | ☐ | PC Boards | ☐ | Front panel and casing | ☐ | | |

II. Function Test (chap. 2)

| | | | |
|---|---|---|---|
| High Pressure Unit HPU | ☐ | Low Pressure Regulator LPR | ☐ |
| Niederdruckeinheit LPU | ☐ | Flow Volume | ☐ |
| Warning overpressure | ☐ | Blockage Alarm | ☐ |
| | | Gas Heater | ☐ |

III. Remarks

_____

_____

_____

Date _____ Signature _____

## Test Record

| Date | Result | Remarks | Signature |
|---|---|---|---|
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## Return form

If you have to return the device, please fill out the card below and mail the manual back with the device.

**Name of owner:**

**Zip code:**

**City:**

**State/Province:**

**Country:**

**Type of device:**

**Device identification number (see ID marker):**

**Description of defect:**

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